ABSTRACT

OF

The Proceedings of the Thirty-Eighth Annual Meeting of the Association of Life Insurance Medical Directors of America

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THE ASSOCIATION OF LIFE INSURANCE
MEDICAL DIRECTORS OF AMERICA

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by
Order of the Association

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William Evelyn Porter, M. D.	1912-1914
Franklin C. Wells, M. D.	1913-1915
Homer Gage, M. D.	1914-1916
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C. F. S. Whitney, M. D.	1922-1924
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An Abstract of the Proceedings

OF THE

Association of Life Insurance Medical Directors of America

THIRTY-EIGHTH ANNUAL MEETING

The Thirty-eighth Annual Meeting of the Association of Life Insurance Medical Directors of America was held at the Hotel Biltmore, New York City, on October 27th and 28th, 1927. The Association was the guest of the Pacific Mutual Life Insurance Company of Los Angeles. President Wesley W. Beckett was in the chair.

The following members and delegates were present at some time during the sessions: G. E. Allen, C. D. Alton, T. D. Archibald, W. B. Aten, A. E. Awde, W. C. Bailey, G. H. Barber, W. B. Bartlett, J. T. J. Battle, W. W. Beckett, R. A. Behrman, M. B. Bender, E. B. Bigelow, A. W. Billing, W. F. Blackford, W. M. Bradshaw, B. C. Brooke, C. T. Brown, B. F. Byrd, F. W. Chapin, L. D. Chapin, J. P. Chapman, C. L. Christiernin, F. M. Cochems, M. W. Colgin, Henry Colt, E. A. Colton, H. W. Cook, D. B. Cragin, H. C. Cruikshank, George Cullen, R. M. Daley, H. M. Decker, E. G. Dewis, H. K. Dillard, W. W. Dinsmore, W. F. Donald-

son, P. G. Drake, O. M. Eakins, C. H. English, W. G. Exton, R. M. Filson, Paul FitzGerald, H. M. Frost, F. I. Ganot, W. S. Gardner, H. W. Gibbons, A. H. Gordon, J. K. Gordon, Angus Graham, A. H. Griswold, F. L. Grosvenor, W. F. Hamilton, Frank Harnden, W. L. Hilliard, D. W. Hoare, A. B. Hobbs, J. C. Horan, Ross Huston, W. G. Hutchinson, Lefferts Hutton, W. C. Huyler, C. B. Irwin, W. A. Jaquith, B. Y. Jaudon, F. L. B. Jenney, A. O. Jimenis, A. E. Johann, G. E. Kanouse, O. W. King, R. J. Kissock, A. S. Knight, W. P. Lamb, A. J. Lanza, J. M. Livingston, C. B. McCulloch, A. A. MacDonald, L. F. MacKenzie, F. W. McSorley, H. L. Mann, R. W. Mann, W. L. Mann, L. W. Martin, Paul Mazzuri, O. F. Maxon, H. L. Metcalf, W. F. Milroy, J. T. Montgomery, William Muhlberg, Herbert Old, M. I. Olsen, G. W. Parker, J. A. Patton, J. S. Phelps, C. B. Piper, J. E. Pollard, F. P. Righter, J. A. Roberts, T. H. Rockwell, O. H. Rogers, E. K. Root, R. L. Rowley, C. L. Rudasill, S. C. Rumford, E. F. Russell, H. C. Scadding, C. E. Schilling, S. B. Scholz, Jr., E. M. Shepherd, J. T. Sheridan, A. L. Sherrill, D. M. Shewbrooks, R. L. Shields, J. L. Siner, C. E. Skinner, Dewitt Smith, J. M. Smith, M. K. Smith, T. A. Smith, W. B. Smith, Morton Snow, H. B. Speer, S. C. Stanton, H. F. Starr, J. B. Steele, Carl Stutsman, L. G. Sykes, B. C. Syverson, W. E. Thornton, P. E. Tiemann, F. L. Truitt, J. P. Turner, C. A. Van Dervoort, G. A. Van Wagenen, C. E. Waits, W. R. Ward, W. E. H. Wehner, F. S. Weisse, F. L. Wells, D. E. W. Wenstrand, C. F. S. Whitney, T. H. Willard, R. L. Willis, Gordon Wilson, M. C. Wilson and G. E. Woodford.

There were present also Drs. H. H. Amiral, S. R. Benedict, F. R. Brown, H. D. Chadwick, C. W. Eveleth,

Otto Folin, S. H. Remick, A. R. Rose, F. D. Sherwood, P. V. Wells and Mr. Robert Henderson.

Total attendance at all sessions, 157.

On motion the roll call was waived and the members were requested to register their names in the book provided for that purpose.

On motion the reading of the minutes of the thirty-seventh annual meeting of the Association, held on October 21st and 22nd, 1926, was waived.

The names of the following candidates recommended by the Executive Council for membership in the Association were presented:

Dr. Parker M. Cort, Aetna Life Insurance Company, Hartford, Conn.

Dr. Hamilton C. Cruikshank, Manufacturers Life Insurance Company, Toronto, Ont., Canada.

Dr. George Cullen, Illinois Life Insurance Company, Chicago, Ill.

Dr. James B. Eagleson, Northern Life Insurance Company, Seattle, Wash.

Dr. Ralph M. Filson, The Travelers Insurance Company, Hartford, Conn.

Dr. William L. Hilliard, The Ontario Equitable Life and Accident Insurance Company, Waterloo, Ont., Canada.

Dr. Oscar W. King, Equitable Life Assurance Society, New York City.

Dr. H. Clive McAlister, The Lincoln National Life Insurance Company, Fort Wayne, Ind.

Dr. Milton T. McCarty, Peoples Life Insurance Company, Frankfort, Ind.

Dr. Albert A. MacDonald, The National Life Assurance Company of Canada, Toronto, Ont., Canada.

Dr. George P. Paul, Aetna Life Insurance Company, Hartford, Conn.

Dr. John J. Post, Pilot Life Insurance Company, Greensboro, N. C.

Dr. Samuel C. Rumford, Continental American Life Insurance Company, Wilmington, Del.

Dr. Raymond M. Schulte, Western Union Life Insurance Company, Spokane, Wash.

Dr. Ross L. Shields, Mutual Life Assurance Company of Canada, Waterloo, Ont., Canada.

Dr. Clarence E. Skinner, Western Union Life Insurance Company, Spokane, Wash.

Dr. Hector M. Stevenson, Aetna Life Insurance Company, Hartford, Conn.

Dr. Archibald R. Stone, Missouri State Life Insurance Company, St. Louis, Mo.

Dr. Bion C. Syverson, Equitable Life Assurance Society, New York City.

Dr. Reynold C. Voss, Pan-American Life Insurance Company, New Orleans, La.

On motion, duly seconded and carried, the Secretary was instructed to cast a ballot in favor of the election of each of these candidates.

The Secretary announced the ballot so cast, and the candidates were declared elected to membership in the Association. The President appointed Drs. Sykes and Muhlberg a Committee to introduce the newly elected members to the Association. Six of these members were present and they were escorted into the room by the Committee, as follows: Drs. Hilliard, Syverson, King, MacDonald, Filson and Cullen.

The Secretary reported that Dr. Henry H. Schroeder, formerly Medical Director of the Mutual Life In-

surance Company, New York City, had been recommended by the Executive Council for Emeritus Membership, and that Mr. Robert Henderson, Vice President and Actuary of the Equitable Life Assurance Society, New York City, had been recommended for Honorary Membership. On motion duly seconded and carried, these gentlemen were admitted to Emeritus and Honorary Membership respectively.

It was announced that the following persons were present at the meeting as delegates from the American Life Convention group of Associate Companies:

Dr. B. C. Brook, Montana Life Insurance Company, Helena, Mont.

Dr. H. M. Decker, Register Life Insurance Company, Davenport, Iowa.

Dr. B. F. Byrd, National Life and Accident Insurance Company, Nashville, Tenn.

Dr. L. W. Martin, Old Colony Life Insurance Company, Chicago, Ill.

Dr. E. M. Shepherd, Life and Casualty Insurance Company, Nashville, Tenn.

Dr. W. F. Donaldson, Standard Life Insurance Company, Pittsburgh, Pa.

Dr. M. W. Colgin, Texas Life Insurance Company, Waco, Texas.

Dr. H. L. Metcalf, Springfield Life Insurance Company, Springfield, Ill.

Dr. F. M. Cochems, American Life Insurance Company, Denver, Colo.

Dr. Beckett—We are very glad to welcome these delegates to our sessions and extend to them the privilege of the floor.

The Secretary read the minutes of the meetings of

the Executive Council of May 18, 1927, and October 26, 1927. On motion these minutes were adopted as read.

Dr. Beckett—I am exceedingly sorry that the President of the Pacific Mutual Life Insurance Company of California is not present this morning to welcome you to these sessions. It would have given us a great deal of pleasure, and had it not been for my good friends here I might have had you in California. You know, as I said at one time, we would like to show the members of this Association the Golden Gate as that would probably be about the only way that you will ever get to see it. But it wasn't for me to say where the meeting would be held; therefore it is in New York. The next place to Los Angeles, you know, is New York.

However, I hope you will all have a most excellent time at this meeting. Luncheon will be served in a room just across the hallway at the adjournment of this meeting, and also tomorrow. The banquet will be at 7:00 o'clock this evening in a dining room on this floor. If there is anything that the Pacific Mutual can do for you while you are here, call on me.

It is with deep regret that we note that during the past year three members of this Association have died:

Dr. Ernest A. Wells, Aetna Life Insurance Company, Hartford, Conn.

Dr. John C. Young, American Life Insurance Company, Detroit, Mich.

Dr. Edward B. Kellogg, John Hancock Mutual Life Insurance Company, Boston, Mass.

The following memorials were read and on motion it was ordered that they be printed in the Proceedings of the Association and that copies of them be sent to the families of the deceased.

ERNEST ALDEN WELLS, M. D.

(Presented by Dr. Edward K. Root)

Dr. Ernest Alden Wells, Associate Medical Director of the Aetna Life Insurance Company, and a member of the Association of Life Insurance Medical Directors since 1914, died April 15, 1927, following an operation for gall stones.

Dr. Wells was born in Rocky Hill, Connecticut, July 1, 1875; graduated from the Hartford Public High School in 1893, Yale University in 1897, and from the Medical School of Johns Hopkins University in 1901. He served an interneship in the New York Hospital and commenced practice in 1903. He was soon recognized by his professional associates as a surgeon of unusual ability and since 1906 or 1907 practically confined his professional labors to surgery.

He was a charter member of the American College of Surgeons, a member of the Connecticut State Medical Association and the Hartford Medical Society. He was secretary of the New England Surgical Society, besides being a leader as well as a member of numerous social, literary and scientific societies.

Dr. Wells was appointed Associate Medical Director of the Aetna Life Insurance Company in 1905 and it soon became obvious that his ability as a surgeon and his mature judgment of surgical conditions rendered his services of unusual value in cases involving accident and liability, especially in the compensation branch of modern insurance medicine. Few members of our profession were so well versed in the details of the law of various states governing compensation insurance, and his opinions and briefs prepared for the

benefit of our legal advisors in these cases were of the utmost value to the company he served.

Dr. Wells was not a frequent attendant at the meetings of this Association and was probably known personally to but a few of its members, but to those of his associates in the home office of the Aetna Life with whom he came in daily contact, he had by his unfailing cheerfulness, optimism and modesty made for himself a reputation for clean thinking, just action and loyalty to the company as well as endearing himself to all his associates by his strong character and lovable personality.

His sudden and unexpected death has made his associates feel a sense of great personal and professional loss and they deplore the loss of a man of his high character to the Life Insurance profession.

JOHN C. YOUNG, M. D.

(Presented by Dr. William G. Hutchinson)

Dr. John C. Young, Medical Director of the American Life Insurance Company, died at his home in Detroit on March 27, 1927.

Dr. Young was born in Mercer, Pennsylvania, on August 1, 1887. His early education was obtained in the High School of New Wilmington, Pennsylvania, and he later attended Westminster College of that city. For two years he taught in Westminster College and then entered Western Reserve University of Cleveland, from which institution he received his medical degree in 1916. Following graduation he served an

interneship in Harper Hospital, Detroit, and later was resident physician at the Children's Hospital of Michigan in Detroit.

In 1918 he was commissioned First Lieutenant in the Medical Corps of the United States Army, in which capacity he served throughout the war, being stationed at Staten Island. In 1921 he returned to Detroit and entered private practice, and the same year was appointed Assistant Medical Director of the Michigan Mutual Life Insurance Company, which position he filled until appointed Medical Director of the American Life Insurance Company on December 8, 1925.

Dr. Young was a man of splendid character, studious and unassuming. Through several years of rather close association he proved most dependable and of excellent judgment. His early death terminated a rather brief career as Medical Director and removed from our ranks a member with a most promising future.

EDWARD B. KELLOGG, M. D.

(Presented by Dr. Wm. B. Bartlett)

It is my sad duty to announce the death of Dr. Edward B. Kellogg, who was for many years connected with the John Hancock Mutual Life Insurance Company.

Dr. Kellogg was born in Sheboygan, Wisconsin, August 21, 1850. He studied medicine at the Bowdoin College Medical School and practised his profession in Boston for many years. Dr. Kellogg commenced

his service with the Company as Medical Examiner for Boston and vicinity in 1883. He was appointed Assistant Medical Director in 1904 and Medical Director in 1916, being associated with Dr. Frank Wells in this latter capacity.

Dr. Kellogg brought to his work as Medical Director a wealth of experience in general practise, which proved most valuable to him and to the Company. It was his delight, during his last years, to boast of the many insurance examinations he had made and of the many obstetrical cases at which he had officiated.

Dr. Kellogg became a member of this Association on October 4, 1911, and although not an active member nor frequent in his attendance he was always interested in the welfare of the Association.

During the last few years of his life he was not physically able to give active attention to the Company's affairs, but we all pleasantly remember his kind and cheerful nature.

He gradually faded away and died quietly at his home on April 9, 1927, at the age of seventy-six.

Dr. Beckett—The next order of business is the nomination of officers and members of the Executive Council. We will have the report of the Nominating Committee.

The Nominating Committee presented the following report:

"The Nominating Committee of the Association of Life Insurance Medical Directors begs leave to report that at a meeting regularly held on October 26, 1927, the following nominations were suggested:

For President—Dr. Robert M. Daley.

For First Vice President—Dr. J. Allen Patton.

For Second Vice President—Dr. William Muhlberg.

For Secretary—Dr. Chester T. Brown.

For Treasurer—Dr. Charles L. Christiernin.

For Editor of the Proceedings: Dr. Eugene F. Russell.

For Members of the Executive Council: Dr. George A. Van Wagenen, Dr. E. W. Dwight, Dr. Morton Snow, Dr. Robert L. Rowley, Dr. Ross Huston.

All of which is respectfully submitted,

ROBERT M. DALEY,
CHESTER T. BROWN,
WILLIAM R. WARD,
CHESTER F. S. WHITNEY,
THOMAS H. WILLARD, Chairman."

Dr. Beckett—In the regular order of business the report will be taken up tomorrow at the election of the officers. The chair asks for other nominations. If anyone desires to place the name of any other member of this Association before us, they now have the privilege of doing so. If you have no names to present, it will be an order to move that the nominations be closed.

No further nominations being presented, it was moved, and carried that the nominations be closed, and that the Secretary be instructed to cast a ballot for the officers and members of the Executive Council placed in nomination by the Nominating Committee.

The Treasurer, Dr. C. L. Christiernin, read his report. The Auditing Committee, Dr. Daley and Dr. Whitney, reported that the Committee had audited the Treasurer's report and found it to be correct. On motion by Dr. Willard, seconded by Dr. Rogers, it was ordered that the report be accepted and placed on file.

Dr. O. H. Rogers, Chairman of the Special Committee in charge of the M. I. B., presented the report of that Committee, which was accepted with thanks and ordered placed on file.

Dr. Willard, Chairman of the Committee on Public Health, reported that nothing had occurred during the past year to require the action of the Committee, but he recommended that the Committee be continued.

The Association voted to continue the Committee.

Dr. Beckett—The next report will be by the Committee on Correlating Practices of Reporting Urinary Impairments.

Dr. Patton—Your Committee on Urinary Impairments was instructed at the last meeting to give the question further consideration and bring in a report at this meeting, previously notifying each member company of the report that the Committee had in mind, with the request that the member companies signify to that Committee their opinion of the report or be prepared to discuss it at this meeting.

Under date of May 23, 1927, each member company was sent a copy of the report of the Committee. The letter sent with the report called to your attention the fact that the report was being submitted to you with the request that you criticize it to the Committee so that the Committee could meet again and modify their report to agree with the criticisms, or that you be prepared to discuss it at this meeting.

Since the Committee received direct comments from only a few companies, we practically submit the same report that we did last year. I will read again the copy of that report.

One of the criticisms the Committee received ap-

proved the first five sections. Concerning Number 6, which refers to counting the red blood and pus cells, they questioned the method where practically the entire field was covered with the cells. I think if you have so many you can't count them, your designation obviously would be the symbol for blood or pus. You would have over your 5 or over 10 cells per field.

One of the criticizing companies—possibly we shouldn't say criticizing, but say commenting companies—raised a question as to why the Committee, in Subdivisions 7 and 8, suggested limits for the report. You will recall that the official code of 1925 does not specify the number of cells to be reported for hematuria or pyuria. You have your symbols for those two conditions, but no standard is given the reporting company as to when they should or should not report. Inquiry has developed that some companies have reported hematuria with one blood cell, and it was the desire of the Committee to obtain the consensus of opinion of this Association as to whether we should put a low limit on it—there is no high limit. I venture to say that the large majority of the contributing companies disregard less than ten pus cells per field as being of any moment whatever in their consideration of the case, that is, of course, provided the case had no other impairment; and if this Association sees fit to continue the instruction to its member companies that hematuria should be reported if one or more blood cells, and pyuria if one or more pus cells, it is an obligation on the companies to continue reporting. If the Association sees fit to adopt the Committee's suggestion that less than five blood cells be not

reported as hematuria, or less than ten pus cells as pyuria, then the companies would so report.

The comments of the various companies, about fifteen in number, that did report were favorable. I want to thank, on behalf of the Society, Dr. Henry W. Cook for some special efforts he made in regard to getting in touch with several of the leading clinical medical teachers of the country. They gave a practically unanimous opinion that the adoption by this body of a definite outline for urinary reports would be of distinct advantage to clinical teachers as well as to this Association. They agreed that they had no uniform methods in some of the leading hospitals and in the medical schools. They had no uniform method to recommend to the students or for their own routine work for urinalyses, and Dr. Cook wound up his communication with the suggestion that it might be wise for this Association to bring to the attention of the medical societies and the leading hospital laboratories the advisability of having a uniform method of reporting their urinalysis findings.

REPORT OF THE COMMITTEE ON URINARY IMPAIRMENTS

A. Your Committee desires to report as follows concerning the microscopic methods for recording casts, blood and pus in urinalyses:

1. The sediment should be from about 15 c. c. or a half ounce of urine centrifuged at a rate of 2,000 to 2,500 revolutions per minute for at least 10,000 revolu-

tions. Care should be used in applying the centrifuge brake so as not to disturb the sediment when stopping the centrifuge.

2. Place on a slide the entire sediment if no coverslip is to be used, or one half the sediment if using a 7/8 by 7/8 coverslip. Use a capillary pipette, which does not require suction so that if using a coverslip a representative sample can be taken from the top, middle and bottom of the sediment.

3. The method of illumination is important. If it is some form of artificial light, the heat from this should not distort the sediment by evaporation.

4. Examine thoroughly first with low power objective 2/3 or 16 mm. and then as needed with high power objective, 1/6 in. or 4 mm. with 1 inch or 10 power (x) eyepiece used so that the total magnification is known in estimating the field.

5. Casts should be reported by number in one-half ounce of urine as defined under symptoms of multiple significance in the 1925 code of official impairments.

6. Red blood and pus and epithelial cells should be recorded separately as so many per field. The standard field for this purpose is that of the 6x eyepiece and the 1/6 or 4 mm. objective. Enough fields should be counted (15 to 20) to be sure the count is representative of the entire slide.

7. Red blood cells should not be reported as hematuria unless there are more than five (5) of these cells per standard field.

8. Pus cells should not be reported as pyuria, un-

less there are more than ten (10) of these cells per standard field.

9. The use of symbols of multiple significance to denote the number of blood or pus cells is not recommended by this Committee nor by the 1925 code of official impairments.

B. Albumin reporting has been considered by this Committee and no change is deemed advisable from the tests approved by this Association in 1924 at the 35th Annual Meeting.

The table below shows the approved limits and their equivalents in the 1925 code of official impairments.

1924 Approved	Percent	Mille %	1925 code
Small	.01 -.05	10- 50	Trace
Moderate	.051-0.1	51-100	Moderate
Large	Over 0.1	Over 100	Large Amount

J. Allen Patton, M. D. Chairman,
A. S. Knight, M. D.,
T. H. Rockwell, M. D.,
William R. Ward, M. D.

Dr. Beckett—What will you do with the report?

It was moved by Dr. Wilson and seconded by Dr. Willard and duly carried that the report be approved.

Dr. Beckett—I would like to ask Dr. Daley to come to the platform.

Dr. Daley in the chair.

Dr. Beckett—In lieu of presenting to this Association an address, which is customary for the President, I have foregone that privilege and presented a paper, which I think most of you have probably had an opportunity to read, on "Disability Insurance."

DISABILITY INSURANCE

by
W. W. Beckett, M. D.
Vice President and Medical Director
and
D. C. MacEwen
Junior Vice President
The Pacific Mutual Life Insurance Company

Over a long period of years companies issuing personal Accident and Health Insurance have gained a thorough knowledge of the requirements necessary to underwrite this type of coverage successfully. The underwriting of Permanent Total Disability Insurance and Non-cancellable Income Insurance presents many new problems. While Accident and Health underwriting principles can be used as a guide, they require considerable adjustment before they cover all of the underwriting requirements of Permanent Total Disability Insurance and Non-cancellable Income Insurance.

This comparatively new form of insurance involves the acceptance of larger amounts of disability indemnity than is usual under Accident and Health policies. This applies particularly to Health Insurance. Permanent Total Disability Insurance and Non-cancellable Income Insurance are based on an "elimination" or "waiting" period, ranging from two weeks to six months. The ordinary forms of Accident and Health policies provide indemnity from the first day of disability, and it is necessary that the premium be suffi-

cient to cover claims which would otherwise be excluded under the elimination or waiting period plan of insurance. This, naturally, permits the insurance on a waiting period basis to be purchased at a much lower premium than that charged for coverage from the first day, and the result is that applications are received for policies providing larger indemnities.

It has been conclusively proved that the period of disability increases with the amount of the indemnity, and it is imperative that companies make a careful selection of these large risks which they are putting on their books. Also, under the ordinary forms of Accident and Health Policies the companies are permitted more latitude in the acceptance of applications by reason of the protection afforded by the cancellation clause. If unfavorable developments occur and the risk becomes one which was not contemplated at the time the insurance was issued, the Company has the privilege of terminating the insurance, but under Permanent Total Disability and Non-cancellable Income Insurance the Company is required to carry the liability, regardless of developments, as long as the premium is paid.

Moral Hazard: One of the most difficult conditions with which the underwriter has to contend is the moral hazard. This hazard may take either of two general forms: Through misrepresentation and falsification in the application, the Company may become saddled with a wholly undesirable risk. The other form of moral hazard makes its appearance in connection with claims under policies which may have been legitimately obtained, but where the claims themselves, if not wholly fraudulent, present every evidence of malingering.

In passing upon applications, the risk must be scruti-

nized from every angle. It is not sufficient to know that the applicant is in sound condition physically and financially. The character of the man himself must be considered. What has been his reputation in the past? Does the Inspection Report bring out the fact that he is known to be a sharp dealer? That he has engaged in transactions which have been just within the law? That his reputation for honesty and integrity is not of the best? This insurance is issued to cover until age sixty, for periods ranging from five to thirty-five years, based on age at entry. Many things can happen during that time. Let us assume that as the years pass, he suffers business reverses to the extent that his income is considerably impaired. The chances are that he will turn to his insurance policy as the most likely means of bolstering up his income. There are many different ways in which a troublesome claim can be presented. Let this same type of man have a legitimate disability for a period of a year or even six months. At the end of that time, it is going to be difficult to get him to give up the income under his policy and go back to work. He will be inclined to malinger. The man of unimpeachable character thinks only of recovering and getting back on the job in the shortest time possible. The other man thinks only of how much and for how long he can force the insurance company to pay. It is essential, therefore, that the underwriting of this class of insurance go beyond the mere question of physical and financial condition. We must know the character of our man, his business reputation and his standing in the community.

The question of habits, especially drink habits, should also be considered. A Scotchman once said, "Some

whiskey is better than other whiskey, but there is no bad whiskey." That was said before the Volstead Act became effective. Since prohibition it is more difficult to find out just how much a man drinks. Many people keep intoxicating liquors in their homes and are constant users, who, before prohibition, were only social drinkers. The illicit manufacture of whiskies and the questionable importations make it most difficult to know just what one purchases. The men who traffic in this commodity care but little about the quality of the goods they sell, just so they make the sales and escape the law. It is my opinion, however, that the excessive users of intoxicants are largely confined to the wealthier class and that the middle and lower classes are drinking much less than before prohibition on account of the difficulty in getting it. A careful investigation should be made in every case when excessive use of intoxicants is suspicioned.

The Application and Medical: Applications for insurance should be so worded that the questions go carefully into all phases of the risk and the medical examination should be equally comprehensive. Personal history takes on a significance beyond what might be considered important, were Life Insurance only involved. The so-called "minor illnesses," particularly if frequent and persistent, may be danger signals of serious disabilities to follow.

Incontestable Clause: Life Insurance Companies, as a rule, allow their Permanent Total Disability Benefits to follow the Life Insurance, insofar as incontestability is concerned. When a policyholder has had his insurance for a year, the Company is not privileged to contest his statements in the application or medical. This feature, insofar as the widows and orphans are

concerned, is a desirable one, but its desirability is questionable as respects the man who deliberately misrepresents his risk and falsifies his application to secure disability benefits for his own needs and purposes. Under most forms of Non-cancellable Policies, the policy can be contested by the Company on the grounds of misstatements and misrepresentations in the application, at any time during its life. Some of these policies have what is known as an Incontestable Clause, but this clause refers only to the time of the happening of the cause of a disability, and does not modify the Company's right to challenge the contract on the basis of fraud or misrepresentation.

Occupation and Environment: Certain well defined hazards attach to many occupations. These hazards are due to the occupational exposure. They are definite in their nature and can be properly covered by an increased premium charge. There are other occupations which present indefinite hazards for which no provision can be made. For instance, a man may be temporarily engaged in promoting a scheme which for a short time is paying him large returns. These returns may be temporary in their nature, and after the particular work is finished, the man may be without employment. Men so engaged are not desirable risks for Disability Insurance on account of the instability of their incomes. There are other occupations, such as authors, writers and composers, where the question of disability is hard to establish, because of an indefinite knowledge of the character of the work.

A man's working conditions or environment may have a bearing upon his insurability. An Inspection Report recently received stated that the applicant, who

was a dentist, was working long hours and keeping his office open at night to accommodate patients who were not able to see him in the daytime. The reporter mentioned the fact that the applicant was showing the effects of the strain of overwork. The application was declined, and within a few months the Inspection Company submitted additional information to the effect that the applicant had completely broken in health and his physician had ordered him away for an indefinite period. Men who are known to be working under a mental strain, who are noticeably irritable and nervous, are not desirable risks. Indefinite nervous breakdowns usually follow when these danger signals are displayed.

There is a type of risk, usually found amongst the foreign born portion of our population, which looks upon Disability Insurance as an investment. Their ideas of business ethics and the proper purpose of insurance are warped, their living conditions are not of the best, and their physical condition is not up to par. Claims from this class of policyholders are inevitable and prolonged.

Overinsurance: Insurance is based on the value of the thing insured and the extent of the loss sustained. In the case of Disability Insurance, the thing insured is the policyholder's earning power. A man may have an income derived from rents, royalties, interest on investments and from other sources, which income goes on irrespective of whether he is well or sick. Such an income is not insurable under a Disability Policy. The income which is insurable is that which the policyholder earns by his own efforts and which he loses or has seriously impaired by reason of his disability.

Earned incomes cannot be insured for an amount

in excess of their value or for even one hundred per cent of their value. The monthly indemnity must be for an amount less than the amount of monthly income. The reason is obvious. There is no incentive for a man to return to work if he loses nothing by reason of laying off. The length of the period of disability increases directly in proportion to the amount of the indemnity paid. Two men each earning $400 a month suffer the same kind of a disability. One is insured for $100 a month, the other for $300 a month. The $100 man will be back on the job before the $300 man.

After Disability Insurance has reached a certain amount per month, it passes beyond necessary insurance protection and becomes a luxury. The claimant carries on without financial loss and suffers no hardship. Consequently, he has no inclination to get back on the job and earn for himself again.

Other Insurance: When Permanent Total Disability or Non-cancellable Insurance is being issued, the issuing company should know how much similar insurance is carried by an applicant, and it should know definitely the amount of his earned income. Companies should have no hesitancy in asking their applicants for this information. The thing to be insured is the applicant's earned income, and the Company has a right to know the value of the thing which it is insuring. Some of the Life Insurance Companies issue Permanent Total Disability Benefits without paying any particular attention to the amount of similar benefits or of other forms of Disability Insurance carried in or being issued by other companies. Without a doubt, the time will come when each applicant will be required to submit a statement to each Company of

the amount of Disability Insurance which he carries, and insurance will not be issued for an amount in excess of that amount which each Company, in its judgment, feels should be issued.

The underwriting requirements applying to Permanent Total Disability Insurance are governed by the average Life Insurance Policy. If the average Life Insurance Policy is $2,500, the average Permanent Total Disability Benefit will be $25 a month, on the basis of $10 monthly indemnity with each $1,000 Life Insurance. If it is $3,000, the Permanent Total Disability is $30 a month. The Non-cancellable Policy, which is written without Life Insurance and is confined in its issuance largely to business and professional men, averages about $250 a month. It stands to reason, therefore, that with business averaging $30 a month under Permanent Total Disability Benefits, as against $250 a month under the Non-cancellable Policy, companies can possibly be more liberal in the acceptance of risks for Permanent Total Disability Benefits.

Physical Impairments: In its Non-cancellable Division our Company adopts the general principle that if an applicant is suffering from an impairment of a nature requiring modification in the policy, the risk is not acceptable for Non-cancellable Insurance, while under Permanent Total Disability Policies certain cases of this kind can be accepted. Non-cancellable Income Insurance is not issued to applicants who have lost a hand or a foot or the sight of an eye. Nor are Non-cancellable policies issued where it is necessary to secure a waiver for such conditions as rheumatism, appendicitis, lumbago and so on. In the case of impairments involving limbs and eyesight, the applicant

is not only more liable to injury by reason of his not being in possession of all his members, but his liability to disability is greater if he should injure one of the unimpaired members, and even though a release is taken, these releases are not always satisfactory.

For instance, if an applicant has sustained the loss of one eye, and the Company issues a Non-cancellable Policy with a release, stating that no indemnity shall be payable by reason of disability caused by blindness, what would happen if the policyholder should be so unfortunate as to lose the sight of the other eye? True, no indemnity would be payable by reason of the release taken, but the Company has on its books a blind man, insured for, say $250 monthly indemnity. Who is to determine what form of sickness or injury shall constitute total disability in a blind man?

An applicant for Permanent Total Disability who has lost the sight of one eye, if accepted, should be restricted against blindness; likewise, a man who has lost one arm or a leg should be restricted against disability in case he should lose the other arm or leg. An applicant who is deaf in one ear should be restricted against disability should he become totally deaf in the other ear.

In general, physical impairments requiring a rating of over twenty-five per cent should not be given Disability Insurance.

The Examiner: Added responsibility is placed on the physician who examines applicants for Permanent Total Disability or Non-cancellable Insurance. The examiner who has become accustomed to examine for Life Insurance and who is familiar with the rules and regulations applying thereto has to revise his standards of measurement of risks for Disability Insurance.

Minor conditions having no particular significance in connection with an applicant for Life Insurance may have a vital bearing on an applicant for Disability Insurance. Personal history is particularly significant, and examiners must be trained to develop all information necessary for the Company to pass upon the application intelligently.

It should be constantly borne in mind in selecting risks for Disability Insurance to avoid, especially those cases that are apt to produce long claims, as tuberculosis, insanity, paralysis, circulatory diseases, blindness, nervous prostration, et cetera.

Tuberculosis: Disability Insurance should not be granted to an applicant whose family record shows two or more cases of tuberculosis; when the applicant is twenty per cent underweight and under thirty years of age; when the applicant gives a history of ever having had pulmonary tuberculosis; or a history of frequent or prolonged attacks of bronchitis, influenza or pleurisy. Residence and environment should also be taken into consideration.

No impairment causes so much concern and bewilderment in the selection of risks for Disability Insurance as tuberculosis. So many conditions influence the inception of this disease, it is difficult to place a proper value upon all of these risks. This is evidenced by the fact that tuberculosis stands at the top of the claims column by a large percentage.

Conditions such as a tuberculous family history, previous personal history of tuberculosis, environment, age, light weight and change of residence on account of health are so outstanding that one is not at a loss to make a decision, but when the information is incomplete or suppressed, where there is a retarded

recovery following pneumonia, influenza or pleurisy, or when there is a loss of weight without definite cause, it is hard to decide such cases.

In selecting Disability Insurance, more care and a greater degree of judgment are required than in the selection of the same class of risks for Life Insurance. The risk might be a standard one for Life Insurance but not at all safe for Disability Insurance. A few years ago we issued Life Insurance to a man who had an incipient attack of pulmonary tuberculosis from which he had recovered seventeen years before the policy was issued. The next year he was given a non-cancellable policy. About three years later he had an attack of influenza followed by a recurrence of pulmonary tuberculosis for which our Company paid him $7,000 disability benefits. He is now well and may live out his expectancy. As a life risk he will doubtless be profitable, but not as a disability risk.

In the selection of Disability Insurance, it is always best to refuse those who do not measure up to the normal standard in regard to tuberculosis. It is difficult to get complete histories. The tuberculous are proverbially optimistic. They may know that they have tuberculosis, but they are sure they are going to recover. They are all hopeful and believe they are getting better when in fact their symptoms show them to be on the down grade. Most of them believe they do not have tuberculosis and if they have recovered after an incipient attack, they are sure they have never had any tuberculous infection and will so state to the medical examiner. The applicant himself may be ignorant of his true condition and the examiner may be careless in his examination.

Tuberculosis often closely resembles in its symp-

toms a severe cold or influenza and an incipient tuberculosis may on this account be overlooked. Youth and light weight are always handicaps and should be considered in connection with Disability Insurance. Dr. MacSweeney[1] says, "for male, incipient tuberculosis adds forty years to the risk at twenty-three years of age in the twenty-eighth to thirty-second year group, nineteen years, and at thirty-three and over, seven to eight years. * * * That sixty to ninety per cent of all deaths occur within five years. * * * Up to the fifth year, consumptives are a foolhardy risk, from the fifth to the tenth much less hazardous, and after the tenth pretty fair." He also states that people with tuberculosis die of tuberculosis. Only five and six-tenths per cent die of anything else.

In the Non-Cancellable Division of our Company, the chief cause of prolonged disability is tuberculosis. The average period of disability of those claims which terminate in death is 12.0 months. The average period of cases which result in an arrestment is 11.7 months. The average period of those cases where disability continues and payments are being made is 17.5 months. The average period of disability on all tuberculosis claims—terminated by death, arrested or where disability continues—is 13.4 months. Twenty-one per cent of the amount paid under non-cancellable policies for diseases of all kinds is paid for tuberculosis. This indicates the necessity for great care in the selection of applicants for Disability Insurance when there is any reason to believe that the applicant may become tuberculous.

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1 MacSweeney, Dr. Edward S.: Proceedings Association of Life Insurance Medical Directors, Vol. 12 (1924-1925), pp. 153-154.

Tuberculosis other than pulmonary should receive special attention, as this disease is always a hazard for Disability Insurance. I think it is quite safe to say that in most cases, tuberculosis, other than pulmonary, is, as a rule, about fifty per cent less hazardous than that of pulmonary tuberculosis.

Who can estimate the value of these cases? In many instances it is not insurance but a bet on the part of the applicant that the indemnities he will receive for disability will be profitable to him, and the company is betting that it will not. Who can give us a reliable tip?

Insanity: Insanity comes second on our claims list. Predisposing causes should always be looked for and carefully considered, such as family history of two or more cases of insanity, syphilis, alcoholism, nervous breakdown and nervous temperament. Applicants presenting any of these conditions are not Disability Insurance cases.

Cancer: Cancer due to traumatism, ulceration or prolonged rectal inflammation, as a rule, is not hereditary, and if operated early and thoroughly is, in most cases, permanently cured. These cases, after a sufficient length of time, might be eligible for Life Insurance. The greatest trouble is to know if all the diseased tissue was removed. I, personally, had a case in my own practice that developed cancer at the seat of operation fifteen years after the diseased tissue had apparently been completely removed. Malignant growths, aside from very exceptional cases, bar Disability Insurance.

Heart Disease: Heart disease will always be a stumbling block. So many examiners fail to recognize the true heart condition or to give a complete picture of

the heart as it really is. This makes the decision difficult. No case of organic heart disease should be accepted for Disability Insurance.

Nervous Prostration: Nervous prostration covers a multitude of sins. It has been called the disease of the wealthy. A person who has ever had a real nervous breakdown is prone to have the same condition again and these claims are so difficult to settle. The mental condition of the claimant tends to prolong the disability. A careful physical examination by a competent physician does not in many cases reveal the full extent of the trouble. The mental state exaggerates the disability. The statements of the claimant are often misleading and unreliable. We have no class of claims that is so trying and annoying to both the adjuster and the claimant as this class. It has been our rule to decline all applicants for Disability Insurance who give a history of nervous breakdown.

Diabetes: The mortality from diabetes is increasing rapidly as shown by statistics, more rapidly than cancer, apoplexy, organic diseases of the heart or Bright's disease. Diabetic mortality is reported to have about doubled in the decade ending 1920 over that of 1890. It is believed that about two per cent of the population of the United States are diabetic. This estimate is based on mortality records. In New York City the mortality from diabetes has increased about sixfold in the last forty years. The life expectancy of diabetics seems to have increased about three years during the last twenty years. The modern methods of treatment have not seemed to lessen the mortality. Heredity is an important factor and should be given serious attention in the selection of these risks. Diseased teeth, tonsils, sinuses, ulcer of the

stomach, chronic disease of the intestines and gall bladder may be causal factors in producing this disease. Over forty per cent of diabetics show a marked obesity before the inception of the disease.

Syphilis: Syphilis is another impairment that makes a lot of trouble in the selection of risks for Disability Insurance. If we could positively know whether the applicant has had syphilis or not, it would not be difficult. Few applicants who have had syphilis are willing to admit it and the question is usually answered "No." If the initial lesion occurred a number of years before the applicant applies for insurance, we are usually told that there have been no subsequent symptoms but only a suspicion was entertained by the physician and no definite diagnosis of syphilis made. In most of these cases, it would be better to give the company the benefit of the doubt.

When we are satisfied that the applicant has had syphilis, we decline or rate him for Life and decline him for Disability Insurance. Syphilitic cases are hazardous disability cases. While many cases may not die directly of syphilis, many do die as the result of syphilis. Syphilis may attack any part of the body and in many cases may affect, unfavorably, the most common disease. No single disease costs insurance companies so much as does syphilis.

In this connection, I am reminded of what Osler once said "The notes of Venus, Vulcan and Bacchus all fall due in the fourth decade, and they are all collected by the end of the fifth."

Neuritis: In reviewing our Company's applications under which claims for neuritis have been made, there was no history or other information which would indicate a subsequent claim for neuritis. We cannot as-

sume, however, that in all cases the history given the Company was true and complete. It developed in some of the claims that there was a prior history not given for which the claim was paid. This disease often results in long disability. Neuritis is, as a rule, due to some focal infection. A careful inspection should be made, especially of the teeth and tonsils.

All applicants with a record of tuberculosis, epilepsy, nervous prostration, neurasthenia, mental derangement, goiter, empyema, asthma, gastric or duodenal ulcer and diseases of the eye are declined permanent total disability and non-cancellable disability by our Company.

In passing upon disability cases, due consideration should be given to the inclusion or exclusion of the disability clause which has an "elimination" or "waiting" period. On account of the difficulty in ascertaining just when one is permanently disabled, our Company assumes that when one is totally disabled for a period of ninety days, he is permanently disabled. With our Non-Cancellable Health and Accident Insurance, coverage is withheld for a period of thirty, sixty or ninety days and charges made to conform with these periods of elimination.

We do not grant Permanent Total Disability to substandard cases having a rating above one hundred twenty-five per cent, and we do not give our Non-Cancellable contract to any but preferred male risks. Women are charged fifty per cent extra for Permanent Total Disability taken in connection with Life Insurance, and it is issued only when the applicant is a wage earner, leaving home each day, working for a stated compensation upon which she is dependent for support.

Granting insurance on a high-priced Endowment offers no additional protection to the Company under the Permanent Total Disability Benefit, for the amount at risk for Permanent Total Disability is as great under an Ordinary Life form as under a Ten-Year Endowment. Permanent Total Disability is no respecter of person, age or occupation. Chinese, Japanese, Indians and illiterates are not given Permanent Total Disability.

Tuberculosis Claims: Of the total number of Permanent Total Disability claims, 33.7% were for tuberculosis. The average period of disability under the terminated claims was 28 months and the average period to date under the open cases is 29 months.

Insanity Claims: The second largest number of claims was caused by insanity, with average disability period of 40 months and the cases still open have an average disability of 47 months.

Paralysis Claims: Matured claims have an average of 33 months' disability. Open claims have an average of 47 months.

Claims (All Causes) by Policy Year: 17.5% of total claims were incurred during first policy year. 18.0% of total claims were incurred during second policy year. 12.5% of total claims were incurred during third policy year.

Dr. Daley—We hope that every member of this Association present has had an opportunity to read this paper. We also hope that the experience of the different companies here represented has been so favorable that it will call for an interesting discussion. The paper is open for discussion.

Dr. Van Dervoort—I shall confine my discussion of Dr. Beckett's paper to three principal points:

Pyramiding Disability Insurance.
Light Weight at Young Ages.
Disability Insurance on Women.

Pyramiding Disability Insurance. Disability insurance was conceived for, and is primarily intended to serve the members of a certain group, namely, the wage earners. It has grown increasingly difficult during the last few years for a man of moderate income to provide to any extent sufficient savings to combat unexpected expenditures for sickness and disability. What a comfort it must be to the individual thus situated to know, that in case death should come his way his family will receive the proceeds of a policy of life insurance, to meet immediate needs, to protect the indebtedness on the home or perhaps to permit the continuation of the children's education. In case disability is of such length and nature as to qualify him a claimant under the benefits of his policy, his monthly disability check, though perhaps small in amount, must be a source of added gratification. It is to the class to which such an individual belongs that disability insurance finds its greatest need.

On the other hand, for the reason that the popularity of disability benefits and desire for them have so impressed the public, we have another problem with which we must contend. Every day we review applications including benefits on the lives of men of wealth. They probably carry much disability insurance, perhaps much more than they are entitled to or that we have knowledge of. Sometimes such an applicant is also very insistent on obtaining the double benefits.

In other words, for reasons not very clear, they desire to pyramid their disability coverage; to be protected against disability without impairment of income. Manifestly such an applicant represents a group for which disability insurance was not primarily intended. I fear we, at the Head Offices as well as the underwriter, at times lose sight of the real purpose of the extra provisions.

During his interview with the prospect, the agent often meets obstacles difficult to overcome because of the increasing demand for the benefits; he finds it difficult to follow the wishes of his company, realizing as he should, the fact that the selection of a risk begins in the field. Why should we at times even strain a point to approve large disability coverage to men of wealth and position to whom total disability, limited or prolonged would but slightly impair their income. Dr. Beckett calls our attention very forcibly to this point.

The earned income of an individual should be the basis upon which the amount of disability coverage is granted. The amount so granted should also be in inverse ratio to one's earned income; that is to say, the younger wage earner may be granted a larger amount of coverage in proportion to earned income than the man of wealth and estate.

The time has arrived I believe when companies granting disability insurance should take more seriously into account the amount of such coverage already in force, not only in the company in which the application is under consideration, but the total in all other companies.

Light Weight at Young Ages. It has always been conceded that family history, particularly when tuber-

culosis is a factor, has a decided influence on the granting of disability provisions, particularly to the younger entrants. This point was thoroughly covered by Dr. Beckett. I am inclined to believe, however, particularly in years gone by, that we have not observed sufficiently well the influence of light weight on disability insurance in young applicants. A few years ago the Company which I represent made a thorough investigation of this feature. We discovered that we were paying monthly checks to a rather alarming number of claimants suffering from tuberculosis, but who at the time of their entrance had a family history free of tuberculosis. We found that in quite a number of this group the matter of weight for height and age appeared to be a real factor. We therefore, immediately endeavored to establish a weight limit within which we might grant the benefits to applicants below 30 years of age, otherwise standard. A table was devised by the Actuarial and Medical Departments to which we have strictly adhered for the past two and a half or three years in connection with this class of applicants. Up to this time we have not made an additional investigation to determine the value of this table to the Company's Claim Division, feeling that the experience for that purpose is not sufficiently long. The table to which I refer is outlined below:

(Light Weight Limit for Disability Benefits—30 Years and Under)

MEN		WOMEN	
5′ 0″	104	4′ 8″	92
1	106	9	94
2	106	10	96
3	109	11	98
4	112	5′ 0″	99
5	115	1	101
6	119	2	103
7	122	3	106
8	125	4	109
9	129	5	111
10	133	6	114
11	137	7	117
6′ 0″	141	8	121
1	146	9	124
2	151	10	128
3	156	11	132
		6′ 0″	136

Disability Insurance on Women. The wage earning single woman, particularly since the World War, has grown to be a believer in and a buyer of life insurance. In most cases she desires disability coverage. This group is one to which disability provision applies, perhaps as correctly as to any other single group of individuals. It is a well known fact that women as insurance risks, selected with the same care as that applied to groups of men, are an advantageous class to carry. However, when it comes to disability coverage this does not appear to be the case.

In January, 1926, the Claims Section of our Company made a very thorough study of this feature of our disability business. I shall quote freely from the data compiled at that time.

Of the total number of disability claims presented to our Company up to the end of December, 1925, 86.2% were on male lives and 13.08% on female lives. It is rather strange that in five years from 1921 to

1925 inclusive the ratio should be exactly the same. If we were to establish a ratio based on an estimated ratio between the sexes under insurance in force, we would be ready to believe that in these figures there is an apparent excess of disability claims on female lives of 97%.

Again women appear to be disabled earlier in the life of their policies than men as shown by the following table:

	Female	Male
Less than five years	78.05	54.60
Less than four years	70.73	45.79
Less than three years	56.10	34.44
Less than two years	34.15	19.18

Of all disability claims, male and female combined, 57.84% of the total were made in the first five years. This shows that the claims on female lives were 20.31% over the average and 23.45% over those of male claimants.

The next table will show a rather interesting exhibit of the division of female claims in this group according to occupation:

Store employees (saleswomen, etc.)	15.85%
Clerical	20.73
Nurses	23.17
Teachers	28.05

Problem. Why do nurses and teachers particularly, show such a large percentage of the total. May it be due to the fact that their occupations probably call for more nervous energy and strain, or because they appear to be the largest classes of employed women to whom insurance appeals.

In our tuberculosis claims in these four groups the arrangement according to number is as follows:

Clerical
Store employees (saleswomen, etc.)
Nurses
Teachers

Women show a higher ratio than men according to the cause of the disability in the following principal groups:

Tuberculosis	5.64	Higher
Rheumatism & Arthritis	3.61	"
Cancer	3.37	"
Heart Disease	3.11	"
Kidney Disease	4.15	"

Men show a higher ratio than women in:

Insanity
Arterial Diseases
Diabetes
Diseases of the Digestive Tract.

Summary.

A. Increasing care and co-operation should be exercised by the companies to overcome the tendency to excess disability coverage on individual lives.

B. The factor of light weight for height is of much importance at young ages, otherwise standard.

C. Disability insurance on female lives appear to be more hazardous and costly than on the lives of males. Therefore, a proper proportionate extra premium should be charged for the benefits.

D. Conscientious liberality in approving claims being the practice of the companies, qualifications for the

benefits should be correspondingly sound and based upon the most careful selection.

Dr. Daley—This discussion, which is really a paper in itself, is valuable to the Association. We would like to hear from some of our members and have a little further discussion of this paper. Dr. Root, can you give us something?

Dr. Root—Mr. Chairman, we have a local association home and we have had several meetings during the past few months considering this disability coverage. We have come to the conclusion—I think I can say unanimously—that it is, as in the past, extremely hazardous business and a money losing proposition. I don't know the company that has not lost money—some have lost more than others—but I don't know the company that has actually regarded their underwriting as satisfactory from a pecuniary viewpoint.

As a result of these various meetings, we have made various suggestions to our various executives, and my own company has appointed a committee to take up the entire question and report to our Directors probably within a month or six weeks, and I hope as a result of that it will enforce more stringent restrictions on our field men and solicitors regarding the disability coverage.

Of course we all recognize the fact that it is a selling proposition, that the field are very anxious to sell it and anything that we suggest in the way of limiting disability coverage has got to overcome the objections of the field force. I can say this, however, that we have in the last few months adopted a rigid table of heights and weights below which fixed standard we do not issue any disability coverage whatsoever.

I would be very glad to know if any of the companies here represented now issue disability coverage in non-medical cases. My impression is that has been the custom in the past with some of the companies, and I should be very glad to know if any of the companies still continue that practice.

Dr. Rockwell—The Equitable does, but disability coverage is limited to $5,000 of insurance.

Dr. Daley—Dr. Rockwell, would you explain the sort of non-medical the Equitable writes?

Dr. Rockwell—The Equitable does not write non-medical insurance on applicants who have not a policy in the Equitable. They may have been examined any time within a year or any time within five years. No case that has been rated substandard is eligible for non-medical. We get inspection reports, as usual, in each case. If the applicant has been accepted within one year, our limit is $10,000; between the first and second years, $5,000; and between the third and fifth year, $2,500. As far as I can tell, our experience, which is very young, has been just about the same as has been on our examined business. In other words, our program is a rather restrictive one, and while I do not state this with authority at all, our belief up to now is that we are getting by with it. We do see instances of anti-selection as we do sometimes when an applicant has been examined recently. Whether there are more instances of anti-selection or not it is difficult to determine unless one has a proper analysis made of the entire group, but with the restrictions that we have at the moment, we are not disturbed about non-medical.

Dr. Daley—Anyone else?

Dr. Frost—We have a little information regarding the financial aspect of disability benefits. Mr. Dow, our Actuary, recently brought together figures on twenty of the leading companies in the country. He finds that the net loss of those twenty companies amounts to approximately $53,000,000 for the years 1922 to 1926, inclusive. Now, out of those twenty companies, there were only four which showed a gain. The maximum gain for any company was about $178,000. The others were less than that. One company, the fifth, was practically even, showing a loss of about $1,200. There were six of the larger companies which accounted for approximately $44,000,000 of that $53,000,000. During the last year 1926, there was only one out of the entire twenty that showed a gain, and that was very slight.

Dr. Daley—Build is a character present in every case, and it is interesting to note that the question of build is pointed out here as being a quite significant factor in these cases. I believe it would be of interest to us if Dr. Rogers, who has been on the Medical-Actuarial Committee and who is quite familiar with build, would make a few remarks. Does the New York Life do disability business, Dr. Rogers?

Dr. Rogers—Ever since the New York Life began to grant disability benefits we have been studying in our office the effects of it in our membership, but we have not carried our investigation far enough to feel justified in making any very definite statements on the subject. The fact is that the growth and extension of disability insurance has been very insidious. Those of us who embarked upon the enterprise began in a very small way and added one liberalizing feature after another until now we find

ourselves in the midst of doing a very large and a very valuable work in a field of effort which has never been explored. It has never been studied or analyzed. The question of the relationship of disability benefits to life insurance is a very burning one and papers like those which we have heard this morning, discussions and contributions like that of Dr. Frost, are most valuable to us. We may be certain of this fact, that disability insurance has come to stay. It is a most valuable addition or supplement to life insurance, but it approaches the problem of insurability from a different angle. It is not so much a question of mortality; it is rather a question of morbidity.

My own impression is that life companies will presently have to get together and present a united front. The field of disability insurance is not one in which the companies can afford to be competitive. They must rather be co-operative. They must see to it that very careful standards are laid down and that all adhere to them; otherwise the fifty millions about which Dr. Frost has spoken will presently be many more millions and may go so far as to jeopardize the insurance business.

Fortunately, however, life insurance covers so broad a field in the social structure that whatever happens, whatever experiments and gropings occur at this time will before very long in the common interest be corrected. A discussion of this sort is of enormous value in that direction.

Dr. Daley—Is there further discussion? If not, we will ask Dr. Beckett to close.

Dr. Beckett—I heartily agree with what Dr. Rogers has said regarding disability insurance. I think that

all of the companies will do disability insurance in time. I think it is a form of insurance that has come to stay, and if it has come to stay and does stay, it will be because the Medical Directors of the different companies select their cases with great care. When a man is insuring for his own benefit largely and not for his beneficiaries, it makes a lot of difference. I believe the important thing in disability insurance, and especially non-cancellable—and now in most of the companies all the disability is non-cancellable—is that it should be very carefully and very rigidly selected.

Regarding our Non-cancellable Insurance, we devised that for preferred risks, and preferred risks only. A border-line case is not a preferred risk or a non-cancellable disability risk. We have, I think, raised our ratings three different times. We probably will again. We don't know yet just what it means to insure men against accidents and health permanently. We don't know how many claims we are going to have and we don't know the length of time each claim is going to extend, so that we feel that we should only take business and professional men on our non-cancellable contract and we feel that we should have those men not perfect, of course, but men who have not had any ailments that permanently disable them or ailments that are likely to recur from time to time. We are especially anxious to avoid long disabilities, insanity, tuberculosis, heart cases, those that when they are disabled are going to cost the company a lot of money.

The Moral Hazard. I tried to lay some stress upon the moral hazard. The moral hazard is very much

greater in disability insurance than in life insurance. There are a number of features with reference to disability insurance that do not pertain to life insurance and I believe that a basis will be arrived at in time that will make it safe for the companies to do disability insurance, but I think we should go at it very carefully. I think we should err, if anything, on the safe side if we are to err at all. So at our office we are trying to exclude all of those cases that we think will have probable claims, the light weights, the over weights at late ages, cases of nervous prostration, etc. A man who has ever had nervous prostration is not accepted by us for disability insurance.

I could mention many conditions that we do not accept at all for disability connected with life and more for non-cancellable. It took us some time and we haven't altogether educated our agents up to the fact that there is quite a difference between disability insurance and life insurance. They think if we can take a man for life insurance, we ought to give him disability insurance, but the company has to pay the bills, and so we feel that the company should say something about the selection of the risks. I believe if the risks are carefully selected, we will in time get on a basis that will make it profitable to the company.

I want to thank you.

Dr. Beckett resumes the chair.

Dr. Beckett—The next paper is, "Mistakes," by our friend, Dr. Eakins, of the Reliance Life Insurance Company. This is a short paper and I would be very glad for Dr. Eakins to read it. Dr. Eakins' papers are always interesting.

MISTAKES

By O. M. Eakins, M. D.

Vice President and Medical Director, Reliance Life Insurance Company

An eminent and able surgeon recently observed that he would like to attend a medical meeting where the contributors would present their mistakes. Then, sadly mixing his metaphors and giving scant consideration to his physiological attainments, he stated he was becoming thoroughly fed up by having to inhale persistently reiterated stories of successes. He admitted his own efforts had been attended, not infrequently, with success, but that he had learned more from his ill, rather than from his fortunate efforts; if others would only portray their failures, all would profit immeasurably.

Perhaps not amiss would be a brief narrative assembling of a few mistakes which have been made in insurance offices. So thinks our President, who requested me to present to you at this meeting something not too torturously monotonous.

An estimable and charming young woman, the daughter of a company's representative, named her mother as beneficiary in her application for insurance. Her medical history was entirely negative save for, two years prior, an attack of "sleeping sickness" of two months' duration with a "complete recovery." About nine months after the company's error, the issuance of insurance, she became totally and permanently disabled from a "partial paralysis which has progressed," and "some lesion in brain," rendering her mentality that of a person of twelve.

One of the most hustling of insurance agents, a particularly live wire and yet a serious man of the highest moral and business character, acquired an undesirable personal rejection record through no fault of his own. His history is of more than passing interest. At the age of twenty, because of eating too much sweets and underdone pork, and following the rigors of army aviation service, he had an attack of auto-intoxication associated with double vision and a general nervous breakdown. For three or four months he languished under hospitalization, had many Wassermanns, all of which were negative except the first, and about a dozen shots of neosalvarsan. One of his physicians wrote he had had encephalitis due to auto-intoxication. On another occasion and to a different correspondent, the same physician also wrote that he had had cerebral syphilis, "original cause not known." This physician evidently was sure neither of himself nor the diagnosis; perchance he was inherently "inadequate between the parietals and above the sphenoid." Being married, having a child, and realizing his responsibilities, this agent endeavored to obtain insurance for himself at about the age of twenty-two. It was then that a luetic history was charged against him. Some months later he was found, on a regular examination, to have exaggerated knee jerks, the right more marked, the leg thrown almost into a condition of clonus. There was no history, evidently sincerely authentic, of any luetic infection, and the incomplete, indefinite, unsatisfactory story of his "breakdown" logically indicated and induced the recommendation of a searching neurological examination. It was done. The neurologist making it (and others concurred on reviewing the findings) expressed the opinion that

lues never was a factor; that an attack of epidemic encephalitis was the entire tale. Although enjoying the best of health, some definite pathology remained, as evidenced by markedly exaggerated reflexes four years after the infection.

The best of neurological minds entertain the opinion that individuals, having had an attack of encephalitis lethargica, are very questionable risks. There are many instances of relapses, subsequent attack worse than the original, occurring up to five years; no offer whatever should be made until five full years, free from neurological symptoms, shall have elapsed since recovery. Even then discriminating care should be exercised, because the terminal results are as yet open to question and probably will be of a serious nature. The trend of well-informed opinion is drawing to the conclusion that the sequelae from encephalitis lethargica are prone to be worse, much worse than those from cerebral lues. If they are, our guidepost has been erected.

Without restrictions, insurance was issued to a man, age 42, who was examined by a competent clinician to whom was given a history of "throbbing of the heart at times." There was found "a suggestion of a murmur, systolic in time, limited to base. This is not organic because of the sound, absence of transmission, and absence of hypertrophy or overaction. Pulse rate 76. Systolic pressure, 120—Diastolic, 85." Although the policy was returned as not taken, it was not a matter of indifference whether a mistake was made or not. Less than three years later, a newspaper carried the item that he had been "stricken with a hemorrhage and succumbed in a physician's office ten minutes after leaving a theatrical performance."

It may be idle to speculate about the exact cause of death, but it surely would be curiosity-satisfying to know. We have been assured recently that the entire book of cardiology must be rewritten. The rewriting of underwriting alleged functional murmurs as standard might also be profitable.

A physician, young, as he was only twenty-nine, had a blood pressure which averaged 137-86. The highest ever found, so far as appears, was 140-86. Incidentally he was an Italian, usually full to repletion of olive oil, heat to be dissipated, garlic and other vegetables leaving no room for any meaty intestinal toxemias. That, nor any other cause for his blood pressure was ever determined; he had been the rounds of competent investigators who fine-tooth-combed him for causational light. Standard insurance—but without disability benefits, later, by executive clemency, incorporated for "business expediency"—was issued to him on the assumption his blood pressure was an individual characteristic, whatever that may be, and of no particular moment. Within three months, in a motor car, he tried to negotiate a corner with a personal method, which disputed all the known laws of physics. One of the bi-products of the argument was a long sojourn in a hospital trying to recover from three fractures of the skull, to acquire more than only occasional lucid moments, and to spin out the thread on which his life was hanging. After much elapsed time he again drove a car, resumed his practice and his garlic. This case is cited only because it may illustrate a point raised last year in connection with the Rogers-Hunter blood pressure study. Although the man resumed his activities, of necessity with a different car from the one in which he had his controversy, he

retained his original medulla oblongata, in which may be situated his thermolytic centers. Whether the dissipation of his inherent heat had anything to do with his tilt at physics or not, is only conversation anyway. The fact remains that an arteriosclerosis around any medullary centers, and whatever their function, makes for them an unhealthy environment, in which they are unable to perform their tricks with the requisite accuracy and dispatch. A life may hang by a thread, poetically, but it also has for supports microscopic points. A thread, even a spider's gossamer in cross section, is a cable in comparison with a nerve cell.

A gentleman carried around with him a fistula-in-ano for a year or so before he grew tired enough of it to have it successfully excised. That termination antedated by two years his application for insurance, which was issued with a considerable rating. Even though he and the agent were both somewhat underweight, the agent emitted more pitiful screams of anguish than were ever extracted by a tight-fitting gate from the most asseverative pig, earnestly seeking his freedom. Both the pinned pig and the agent were simply expressing their resentment at restrictions. His mildest comment was that two big, reputable, reliable and conservative companies each had issued a ten thousand policy. He had not a chance to deliver his, which looked little like that for which application, especial stress having been laid on disability benefits, had been made. The agent was an excellent salesman because, although he had no chance to place the rated policy, he did deliver it. That was a mistake. The other two policies, standard, were two more mistakes. Six years later all three companies paid the

insured's estate sums of money, he having died of pulmonary tuberculosis.

It had a heavy lien and was, according to the agent, a sad looking policy, but he distilled joy out of sadness by collecting his commission. The determination of the lien was based upon an abnormality of the blood pressure. During the first few months of his insurance, he had a spinal cord hemorrhage, and only then was it developed that he had indulged himself in breaches of warranty relative to his physical condition, illnesses, and indemnity claims; to say nothing of his being, personally, an arbitrary, contentious, provocative, litigious soul. Perhaps a rescission of his policy might have been made; perhaps not. It may be a mistake was made in not trying. In any event, he held it three years all told, when he died, of apoplexy. Whimsical sympathy, by all concerned, was gleefully transmitted to the Head Stoker to whose capricious and condign handling he was committed!

The record portrayed an "irregular heart action" due—ingenuously quoth the examiner—"to the intemperate use of tobacco." Sincere addicts who have never been irregular in their smoking nor hearts, who for a trio of decades have never passed up a smoke nor missed a beat, are inclined to be somewhat prejudiced against such an opinion, casually expressed. In any event, twelve days after having "quit smoking," the heart showed a "slight improvement," and in another week, strychnine in the meantime having been exhibited, the same heart revealed a "noticeable improvement." The owner of the heart was thought by the examiner to be a first-class risk "if this irregular heart action continues to improve as I believe it will." The company's intimate advisor, a sincere

smoker, was not quite so sanguine and nominal restrictions were imposed. Not quite three years thereafter, another examiner stumbled over the same heart, finding it "a little irregular," and saying, "I am sure it is due to his stomach, gas formation from spells of indigestion at some times. It is not serious, only when he is inactive and eats something that is hard to digest that he has gas form on the stomach and then he gets a little excited when examined which causes a little irregularity. There is no chronic affection at all and only at times it shows any irregularity. I am acquainted with him and doctored him and should know and his family is excellent in every respect." Naturally, a very illuminating opinion, but the company's intimate advisor, who could digest things that would make an ostrich blush, was not particularly impressed. He continued to be prejudiced and still insisted upon nominal restrictions, which the harborer of this heart accepted. Two years later he regretted the liberality of his "nominal restrictions," because the heart resigned; ceased working for its abuser. "Valvular heart lesion" was reported to the county authorities, as well as to the company. The death may have been due to heart block, or Adams-Stokes', or something, but surely not to valvular lesion, tobacco, nor anything hard to digest. He may even have eaten some matches which touched off his intestinal flatus.

He swore blind he had not had a drink for five years and was off it for life. He probably had been cold sober for that length of time but he acquired a gentle glow eight months later, for which he was sorry and indulged in the usual "never again." He kept his word to himself for twelve weeks. He then promised

himself, with the most definite and positive assurance possible to him, teetotalism. He did not break the promise for nine months, when he broke it properly, and kept it broken for three months. It is not known what affirmations he made to the pink-winged elephant with whom he flew away. His widow profited by both mistakes. There was another man who would have been just like the foregoing were it not that he was much worse. Having a hardier soul and a more tenancious clutch on life, in spite of his avid thirst, unlimited capacity and more prolonged bouts, he outstayed his libidinous contemporary nearly a year, and his widow, also, profited by two mistakes.

In this sort of narrative presentation, a tinge of wordy vagary will be forgiven when it is realized it has been used, in moderation only, for purposes of emphasis. So emphasized, the incidents better become memory-fixed, for later guidance in avoiding a few of the many pitfalls which strew our paths.

Dr. Beckett—We will now hear from Dr. Rogers and Mr. Hunter.

MORTALITY STUDY OF IMPAIRED LIVES NO. 6

By Dr. O. H. Rogers and Mr. Arthur Hunter
New York Life Insurance Company

A. Intermittent or Irregular Pulse.
B. Rapid Pulse.

Since Volume IV of the report on the medico-actuarial mortality investigation was published in 1914 no statistics have appeared on rapid, irregular, or intermittent pulse. In our routine work of investigating several impairments each year, we have been considering those just mentioned and now submit the results.

All of the cases presented in this study were insured as substandard risks by reason of the given impairment. The experience covers the issues of 1907 to 1924, inclusive, carried to the anniversaries in 1926 and is by policies on the lives of men. The expected deaths were determined by the A. M. Select Table at the true age. We also obtained the expected deaths by using our own company's experience with standard business during the same period.

There has been some discussion in recent years as to the value of the testimony of small groups. Mr. A. T. Maclean recently (T. A. S. A., Vol. XXI, page 528) drew special attention to the care which must be exercised in making deductions from small groups. Mr. W. G. Bowerman has given (T. A. S. A., Vol. XXVII, page 421) a concise description of a method of determining the probable error and also of "the number of expected claims which are needed in order to give any required degree of accuracy in substandard groupings." He gives the probable deviation or error assuming that the mortality table used is representative of the ma-

terial under investigation. The formula is $2/3\sqrt{npq}$, where n represents the exposures, q the expected rate of claim and p is equal to (1—q). As nq is equal to the expected number of claims and p is, as a rule, practically unity, the formula becomes $2/3\sqrt{\Theta}$ where Θ is equal to the expected number of claims. Dividing this expression by the expected number of claims gives $\frac{2/3}{\sqrt{\Theta}}$ which is the ratio of the probable deviation to the expected claims. In this investigation we have shown the probable deviation as determined by this formula, by placing opposite certain of the ratios of actual to expected death this indication of the extent to which they might have been increased or decreased through the limitations of the material. It should be remembered, however, that the testimony of a small group, if confirmed by that of other closely allied small classes, is more valuable than the formula would indicate.

It may be of interest to state that a study of 33,000 cases of men accepted as standard lives showed an average pulse rate of 74 per minute. We found no substantial difference when studied by three age groups but when subdivided by build the pulse rate is slightly greater among persons under the average weight and among underweights decreases as the age advances. The investigations of pulse which follow have been carefully examined from the viewpoint of both build and pulse rate, but no significant results were obtained.

Intermittent or Irregular Pulse

In the M. A. M. I. the groups were so small that it was necessary to combine cases "found on examination" with those having a history "within ten years" of application. The results with respect to those im-

pairments were, therefore, not of much value as guides in the selection of risks. The actual deaths were but 95% (±6%) of the expected for irregular pulse and 113% (±7%) for intermittent pulse. All of these cases were insured on standard plans and these low ratios were due to the small percentage of cases in which the impairment was found persistently on examination and the large percentage in which it was found in but one of several observations. The material which we now present may not, therefore, be properly combined or compared with the medico-actuarial results for the reason that our cases showed the abnormality persistently at the time of examination and were, on that account, insured on substandard plans.

It is to be regretted that our cases were not all reported by the examiner with equal care and skill. The great majority of them, about 80%, examined in the larger cities and towns by experienced men, were easily classified because pains had been taken to clear up any uncertainty as to the nature or extent of the abnormality. In the remaining 20%, from the smaller or distant centres in which it was difficult to obtain detailed information and in cases for small amounts we accepted somewhat vague details such as, "drops an occasional beat," "there is an extra systole every thirty beats," and the like. On the whole, we believe that the amount of error due to imperfection of the records has not been sufficient to materially impair the value of our results.

It may be that, in order to insure greater accuracy in the future, it would be well for all of us to require of our examiners more accurate descriptions of intermittent or irregular pulse, guided by precise definitions somewhat as follows:

Intermittent—in which one or more beats are dropped per minute.

Irregular—in which the beats occur (a) at irregular intervals or (b) are irregular in force or (c) in which both rhythm and force vary.

Intermittent and Irregular—in which the beats are irregular in force or rhythm or both, and in addition some of them are dropped.

For the purpose of making these definitions still more intelligible, they might be illustrated graphically by the use of a diagram in which the force is represented vertically and the rhythm horizontally such as the following:

Intermittent) Rhythm
) Force
Irregular) Rhythm and Force

If all companies were to use some such method of laying the problem before the medical examiners and of securing from them an accurate description of their findings, we should have more valuable data for future study.

Irregular Pulse

Examination of our material, consisting of 1,211 cases, satisfied us that subdivisions into two or more groups, according to degree or amount of irregularity, were not justified. We therefore studied in one group irregular pulse as well as the group of irregular and intermittent pulse, with the following results:

Pulse	No. of Cases	Actual Deaths	Expected Deaths		Ratio of Actual to Expected Deaths	
			A. M. S.	Company Standard	A. M. S.	Company Standard
Irregular	985	64	33.7	31.4	190%	204% (±12%)
Irregular and Intermittent	226	21	10.2	9.5	206%	221% (±22%)

The foregoing results in the two groups are consistent and indicate a rather high mortality.

Intermittent Pulse

The cases in which the degree of intermittency was specified with sufficient accuracy were divided into two groups: (a) those in which the pulse was said to intermit five times or less per minute, or not more frequently than once in every fifteen beats; and (b) those with a greater degree of intermittency. The following synopsis shows our experience:

Pulse	No. of Cases	Actual Deaths	Expected Deaths		Ratio of Actual to Expected Deaths	
			A. M. S.	Company Standard	A. M. S.	Company Standard
Degree not Specified	434	36	23.9	22.3	151%	161% (±14%)
Intermittent Pulse, Group (a)	745	28	23.1	21.5	121%	130% (±14%)
Intermittent Pulse, Group (b)	799	36	26.3	24.4	137%	148% (±13%)
Intermittent Pulse (3 groups combined)	1978	100	73.3	68.2	136%	147% (± 8%)

According to our experience the impairment of intermittent pulse was not as serious as irregular pulse.

In order to get an indication of the incidence of mortality by age we have combined the groups of persistently irregular or intermittent pulse found on examination with the following results:

Persistent Irregular or Intermittent Pulse—at Examination

Ages at Issue	Actual Deaths	Expected Deaths		Ratio of Actual to Expected Deaths	
		A. M. S.	Company Standard	A. M. S.	Company Standard
Under 30	21	18.7	17.4	112%	121% (±16%)
30-49	87	57.8	53.8	151%	162% (± 9%)
50 and over	56	30.5	28.4	184%	197% (±13%)
All Ages	164	107.0	99.6	153%	165% (± 7%)

A similar result is obtained for either of these impairments alone and accordingly the ratings for irregular or intermittent pulse should increase with the age at issue.

In the group of irregular or intermittent pulse deaths from heart disease are markedly heavy, 27%, about four times the normal. The same percentage applies also to the total of the groups of combined impairments given in this paper.

Irregular or Intermittent Pulse with Other Impairments

We have segregated two groups of cases with irregular or intermittent pulse combined with (a) consumptive family history or (b) abdomen greater than chest at rest. In the former are 208 and in the latter 106 cases. A synopsis is now given:

Irregular or Intermittent Pulse	Actual Deaths	Expected Deaths		Ratio of Actual to Expected Deaths	
		A. M. S.	Company Standard	A. M. S.	Company Standard
Plus Consumptive Family History	27	12.8	11.9	211%	227% (±19%)
Plus Abdomen Greater Than Chest at Rest	15	6.1	5.7	246%	263% (±28%)

While the number of cases is not large, the results

are in accordance with expectation, making allowance for the probable deviation.

Rapid Pulse

In the M. A. investigation the cases with a rapid pulse were divided into two groups (a) 90 to 100 and (b) over 100 per minute. In group (a) the mortality was 172% (±5%) and in group (b) it was 205% (±14%). The committee combined in the latter the cases of high pulse rate found on examination with those found within ten years thereafter. All of these risks had been accepted at the regular rate of premium.

In our present study of rapid pulse found on examination we followed the same subdivisions as those of the M. A. investigation. The results for all ages combined are as follows:

Persistent Rapid Pulse Found on Examination

	No. of Cases	Actual Deaths	Expected Deaths		Ratio of Actual to Expected Deaths	
			A. M. S.	Company Standard	A. M. S.	Company Standard
Pulse Rate 90 to 100	1004	43	29.9	27.8	144%	155% (±13%)
Pulse Rate Over 100	229	16	6.9	6.4	232%	250% (±26%)
Pulse Rate 90 and Over	1233	59	36.8	34.2	160%	173% (±11%)

For the first of these classes—pulse rate 90 to 100—the ratio to the company's experience on standard business is approximately 155% (±13%), as against 172% (±5%) in the M. A. M. I. If the actual and expected deaths of the M. A. M. I. are increased by the actual and expected deaths of our experience (taking the expected deaths of the latter according to the company's standard for the period covered by it), the resulting figures in the age groups are as follows:

Pulse Rate 90-100, Found on Examination M. A. M. I. Data Combined With New York Life Material

Ages at Issue	Actual Deaths	Expected Deaths	Ratio of Actual to Expected Deaths
Under 30	115	66.9	172% (±8%)
30-39	118	66.8	177% (±8%)
40 and over	142	87.1	163% (±7%)
All Ages	375	220.8	170% (±4%)

The foregoing analysis suggests that rapid pulse is probably equally significant at all ages.

Conclusions

1. The ratings for persistently irregular pulse found on examination should on the average provide for a double mortality, graded by degree of irregularity and increasing with age at issue.

2. Intermittent pulse is apparently not so serious as either a rapid or irregular pulse and calls for an average rating of about 150%, graded by degree of intermittency and graded somewhat higher at the older ages.

3. The combination of irregular or intermittent pulse with each other or with a family history of tuberculosis or with excessive abdominal girth calls for an average rating of at least 200%, with a lower or higher rating, depending on the seriousness of each impairment.

4. The study of rapid pulse confirms the M. A. M. I. in giving an average rating of about 170% with no marked trend by age, but an increasing rating with the departure of the pulse from normal.

Dr. Beckett—The paper is open for discussion and I will call upon Dr. Weisse of the Mutual Life to open the discussion.

Dr. Weisse: When Dr. Beckett asked me to discuss the paper presented by Dr. Rogers and Mr. Hunter on intermittent, irregular or rapid pulse, I felt some hesitancy about undertaking to do so, as my experience has been that the very valuable papers which these two gentlemen have been kind enough to submit to this Association have not been subjects for discussion. They are positive, definite, carefully tabulated facts and, while it is possible to compare them with the experience of other Companies, I do not think they can be discussed from the point of view of a difference of opinion.

In the Mutual Life we have no substandard basis for comparison. I find that we have a small group of cases that have been accepted at standard rates with irregular, intermittent or rapid pulse.

Group (7)—Pulse Irregular, Intermittent or above 90. Issues of 1907 to 1922, Exposed to 1924. Expected Based on the American Men Select Table. Summary by Ages at Entry, All Policy Years Combined. By Policies.

Ages at Entry	Entrants	Exposures	Deaths Actual	Deaths Expected	Ratio No.	Ratio Amount
15-39	1,061	7,073	30	32.965	91.0	71.1
40 & Ov.	333	2,245	32	29.987	106.7	102.9
Total	1,394	9,318	62	62.952	98.5	91.0

The general experience of the Company for this period, 1907 to 1922, was approximately 85% by numbers and 89% by amounts.

This is a very small group, less than one-third of those submitted by Dr. Rogers and Mr. Hunter, and the great bulk of our cases were at the younger ages. I do not know whether the distribution was the same in the New York Life.

I wish to take this opportunity to thank these two good friends, as I have done before, for their kindness in giving us year after year these valuable studies from their great volume of experience.

Dr. Beckett—Dr. Muhlberg.

Dr. Muhlberg—I entirely agree with Dr. Weisse that it is practically impossible to discuss Dr. Rogers' and Mr. Hunter's paper unless one has some statistical material to submit, but I thought perhaps it might be of some interest to discuss the physiological phases and perhaps venture a differentiation of so-called intermittent pulses, and I have attempted, therefore, to write a very short discussion along those lines.

The Mortality Study of Impaired Lives showing intermittent and irregular and rapid pulses presented by Dr. Rogers and Mr. Hunter is a most valuable and opportune contribution.

I believe it was the tendency of Medical Directors years ago to look askance at even the slightest intermittence and irregularity of the heart's action, in spite of the more optimistic viewpoint of the Mackenzie school. When the M. A. M. I. figures were published, most of us wakened to the idea that our worst fears were unfounded and I am inclined to believe that we went to the other extreme and treated the impairment too lightly. Dr. Rogers' and Mr. Hunter's paper sets us back where we belong; a persistent intermittent or irregular pulse is by no means a slight impairment, and past the age of fifty, it takes rank as a major flaw in the applicant's rating.

Personally, I am grateful to the essayists for giving us a definition differentiating an intermittent from an irregular pulse. I must confess that heretofore

the distinction has been rather hazy in my mind. As a matter of fact, neither term is very scientific or informative, inasmuch as they apply to conditions that range from sinus arrhythmia, through extra systoles and intermittent heart block auricular flutter, to pulsus alternans; and since sinus arrhythmia is of no moment, while pulsus alternans is one of the most serious impairments that exist, the group is necessarily most heterogeneous.

But this fact does not at all detract from the value of the study. In fact, it forms a dependable solid foundation, on which a more elaborate superstructure may some day be raised; and furthermore, the study solves the problem for us in acting on applicants thus impaired, where no further investigation is feasible. In such cases, we know the data are not as complete as we should like for more accurate judgment.

It would unquestionably be the wisest plan not to issue to risks with an intermittent or irregular pulse, except on the basis of electrocardiographic or polygraphic tracings; and where large amounts are applied for, particularly in the larger cities where reliable tracings can be procured, it should be insisted upon. In cases where we have requested such examinations, we have generally been successful in securing the applicant's co-operation. As a matter of fact, it is gratifying how eagerly the bona fide applicants respond to such finer requirements. It is seemingly only those applicants who consider themselves very doubtful risks, who decline to undergo glucose, X-ray or special heart tests.

In the applicants for smaller amounts, we must usually, for practical business reasons, attempt to se-

lect these cases on the basis of such data as can be procured through a careful examination of the heart and pulse, supplemented by one of the effort tests.

While cardiologists are not as yet in strict agreement in their recommendations, there are a few commonly accepted rules that might safely govern us in interpreting the findings—rules that are of value particularly where the examination is made by a skilled physician.

I think we are all agreed that sinus arrhythmia is of practically no significance and that the ordinary careful physical examination can be relied upon to differentiate it.

Extra systoles offer more difficulty, both in diagnosis and prognosis. No doubt an occasional extra systole in young persons of nervous temperament, particularly where there is no real compensatory pause following the extra systole, can safely be regarded as an irritable sinus node contraction, and therefore, of little or no significance; but where the compensatory pause is a full one, indicating that the ventricle is engaged in the pace-making, the prognosis is not so favorable, particularly at ages over fifty. Such ventricular pace-making is not infrequently an evidence of a myocarditis or of a coronary arteriosclerosis. Furthermore, these cases are likely to be confused with partial heart block. Extra systoles arising from more than one focus appear to be of even more significance, in that such a condition would theoretically be indicative of myocardial involvement.

Most of us, I believe, are inclined to view with greater leniency an intermittent heart that becomes perfectly regular where the rate is increased to over

100 through exercise. Theoretically, this appears to be a safe procedure and the heart specialists are inclined to believe so, but it would be interesting to have the matter investigated statistically.

Pulse rates below 40 are practically always heart blocks, and therefore, ought not to be accepted; and a pulse rate of 50 or perhaps 55 that shows any intermittence, ought to be viewed in the absence of heart tracings as probable heart block.

I question whether a true heart block is really insurable, even in spite of the fact that occasionally it results from toxic causes, in which case it will usually disappear after a time. It would be safer in such cases to postpone the risk until the condition does disappear.

I do not suppose that any of us would knowingly accept any cases with auricular fibrillation, and fortunately, the diagnosis is not difficult, because mitral disease generally co-exists and the pulse is usually so irregular in these cases that the patients often find amusement in scaring physicians through having them feel their pulses. But even here, the pulse may not be very irregular and I often wonder how many of such cases we do accept under the impression that they are extrasystolic cases. Cardiologists are now agreed that auricular fibrillation is not so rare as was formerly supposed.

Pulsus alternans is said always to be fatal in less than two years. Since pulsus bigeminus, due to extra systoles, resembles it rather closely so far as the evidence of the pulse can be relied upon, it is of course best to insist on heart tracings in all bigeminal cases.

It may not be so necessary for the larger com-

panies to attempt any finer differentiation of irregular hearts, because with their enormous volume of business they can safely rely on the law of averages to give them results that will agree with Dr. Rogers' and Mr. Hunter's figures; but for the smaller companies, where a few claims make quite a difference in the mortality ratio, an effort to discriminate would seem to be a wise policy.

Dr. Beckett—Dr. Rockwell.

Dr. Rockwell—I regret very much that I am not able to discuss this paper. The notice I had was very short and when I got into the Statistical Department and asked them to lay aside some other duties in which they were engaged, they did not feel quite inclined to do so, and I feel that I would like to contribute real facts rather than theories. But as far as we went, which was not to a conclusion, it did demonstrate that intermittent hearts and fast pulses gave us a considerably higher mortality than the Equitable's standard experience. Certainly all of us believe that a rapid pulse or an intermittent pulse is not good, and with the knowledge we have from Dr. Rogers' and Mr. Hunter's papers, I think we should pay a great deal of attention to the facts that are given there in dealing with such cases.

Dr. Beckett—I would like to ask Dr. Ward if he will give us something with reference to his ideas regarding this paper. Dr. Ward of the Mutual Benefit.

Dr. Ward—We are greatly indebted to the New York Life Insurance Company for their annual contribution. I trust that this may be a habit rather than an occurrence. The fact that these large com-

panies with such a wealth of material are giving to us in such a lavish way the benefit of their information, is a striking illustration of the altruism of life insurance.

In the beginning of Dr. Rogers' paper, reference is made to the fact that we have had no life insurance statistics upon this class since the M. A. Investigation. It may be of interest to us to compare the result of that investigation with the report which Dr. Rogers has given to us. For instance, in Class 29 of the M. A. Investigation which deals with the irregular pulse, from ages 15 to 29, inclusive, there were 7,825 entrants and they gave a mortality of only 79 per cent. Those from ages 30 to 39, inclusive, gave a mortality of 111 per cent; and from ages 40 to 49 inclusive, a mortality of 80 per cent. The mortality of the entire class was only 95 per cent. This is in striking contrast with the figures which Dr. Rogers now presents, namely, 190 per cent. I presume that this difference is due to the fact that the cases included in the M. A. Investigation were the most favorable of the group and that in the vast majority of instances, the irregularity which was found upon the first test was not present in subsequent tests.

On the other hand, I presume that in the substandard group which we now have before us, the irregular pulse was more or less persistent.

In reference to the intermittent pulse, almost the same contrast exists. In the M. A. Investigation, from ages 15 to 29, inclusive, the mortality was only 88 per cent, and the mortality of the entire class which consisted of 12,085 cases, gave a mortality of only 113 per cent.

Emphasis has been made by Dr. Muhlberg to the fact that we should look back of the impairment to the cause of the impairment. In line with that thought, it is interesting to review the paper submitted by Dr. Hart at our Medical Directors' meeting three years ago:

"As far as I know up to the present time irregularities of the heart have been studied statistically only as one large and undifferentiated group. It is my belief that the sooner these statistics are discarded and forgotten the sooner will we be in a position to make a new start on a more rational basis. It would not be of less value to estimate the risk of infections by including in one group mumps, typhoid fever and pneumonia than has been the custom to evaluate the significance of cardiac arrhythmias as one undifferentiated mass."

I think, gentlemen, that it is quite obvious from the comparison of these figures and from the statements of such men as Dr. Hart, that when the time comes when we can differentiate with more precision than we can now do the real cause of these irregular hearts, we will then be in a far better position to know which of these cases can be considered as standard and which as substandard.

It may be of interest to you to know what we are doing in the Mutual Benefit. We do not take irregular hearts if the applicant is over forty years of age, for we fear that there is too great a probability of degenerative change. It may also interest you to know that forty-three per cent of all of our deaths are due to cardio-vasculo-renal disease. Because of that fact, we naturally look with especial care on applicants who are over forty years of age who show any pulse abnormality. If the applicant is

under forty and the case is otherwise free from any condition which would suggest a cardiac lesion such as elevated blood pressure or overweight, and particularly if we can be assured that the irregular heart or intermission has been in existence for a considerable length of time—in other words that it is not a recent development—then we are inclined to view the case with more favor. We frequently employ the test which Dr. Muhlberg has suggested, the exercise test, to ascertain how soon after the exercise the pulse returns to normal rapidity; also to ascertain whether, as a result of the stimulation of exercise, the intermission or irregular heart increases or disappears. This may seem a rather crude method, but thus far, we have found it a reasonably safe procedure. Again, I want to thank Dr. Rogers and Mr. Hunter, and the Company they so ably represent for this most valuable contribution.

Dr. Beckett—Is there anyone else that would like to discuss this paper? Dr. Wilson.

Dr. Wilson—I just want to mention a test for determining the different types of irregular pulses that can be easily done by the average examiner, simply by requiring him to note the blood pressure of six or more successive beats. In a normal regular pulse every beat has exactly the same systolic blood pressure, but in all forms of irregular pulse there are characteristic variations in the blood pressure of different beats that enables one to fairly accurately diagnose the type of irregularity.

In the usual intermittent pulse due to "ventricular extra systoles," which almost always is unassociated with organic disease of the heart, the blood pressure

of successive beats is exactly the same, but the blood pressure of the beat following the extra systole is always higher than the other beats, so that one finds two different systolic pressures, and only two, namely, the blood pressure of the usual beat and the blood pressure of the beat after the pause.

In pulsus alternans which always indicates serious myocardial trouble the systolic blood pressure of successive beats is different, but the blood pressure of alternating beats is the same. Here, too, we have two different systolic blood pressures but unlike "ventricular extra systoles" there is perfect regularity but alternating blood pressure. This type of pulse cannot be recognized with the electrocardiogram, and cannot be as frequently or as accurately recognized with the sphygmograph as it can be with the sphygmometer.

In auricular fibrillation, found only as a rule in seriously damaged hearts we have *more* than two different blood pressures of a series of beats, in fact there may be present beats varying in pressure fifteen or twenty millimeters, and there is no regularity in the variations of pressure such as we find in pulsus alternans.

In order to recognize the above types of pulse with the sphygmometer, it is absolutely necessary that there shall be no air leakage, as one must hold the pressure exactly at the point at which the sound is first heard with the stethoscope below the arm band, and thus listening for the successive beats that one can see registering by the movement of the needle of the Tycos, and noting whether they are heard and if not heard, the pressure can be very slowly lowered,

and thus the pressure of individual beats determined, and the type of irregularity recognized.

In my teaching in the last five years, I have emphasized to my students the fact that high or low blood pressure has very little significance as far as the treatment of the patient is concerned, but if we can recognize, through the blood pressure, auricular fibrillation or pulsus alternans we can institute a definite type of therapy that will undoubtedly prolong life in all cases, and, in some, cure the condition, and for that reason from the patient's standpoint the greatest value of the sphygmometer is in recognizing variations in the blood pressure of different beats rather than in noting whether the patient has a high, normal or low blood pressure.

Dr. Beckett—Is there anyone else; if not, I will ask Dr. Rogers to close the discussion.

Dr. Rogers—This paper of Mr. Hunter and myself is based on risks which the company insured as substandard. In the last few years, we have been making, not as carefully as we hope to in the future, a differentiation between those disturbances of the heart which seem to be important and those which are not important. I have no doubt that we shall discriminate more and more carefully as time goes on. In addition to the risks which we present here as having been insured on substandard plans, we have taken a number of them as standard risks—a number which I think would be comparable to Dr. Weisse's group. These do not appear in this experience. With this point made clear, I am perfectly willing to have the paper stand as written, namely, that these disturbances of circulation are of importance and are especially significant toward the later ages of life.

At the younger ages they show a mortality of 121 per cent of our company's standard which is not very far from Dr. Weisse's table. Evidently we were rather more severe among our young applicants because at the time we thought they were distinctly impaired. If we had not thought so, we would have put them in the standard class instead of penalizing them as substandard risks.

I see a very great future in medical selection in this field by the method that Dr. Wilson has suggested and by the method suggested by Dr. Ward. Certain it is that we shall have to analyze these cases more painstakingly hereafter than we have heretofore.

Dr. Beckett—Is Mr. Hunter present?

Dr. Rogers—Mr. Hunter was hoping to be here this morning but has not yet quite recovered from an operation for infected tonsils. I am sure that he would have enjoyed this meeting and would gladly have contributed to the discussion. I am sure you will all be interested to know that last year Mr. Hunter received the honorary degree of Doctor of Laws from Edinburgh University, a well-earned recognition of his distinguished contributions to actuarial science.

Dr. Beckett—I am very glad that we can have today our next paper. It is a new subject and one which today interests every insurance company, "Aviation and Life Insurance." Dr. Sykes and Dr. Smith of the Connecticut General Life Insurance Company have gone to considerable trouble and have kindly worked out as best they could at the present time what aviation means to life insurance companies.

AVIATION AND LIFE INSURANCE

by

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and

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Interest in aviation in this country has shown enormous strides, moving by leaps and bounds since the memorable non-stop flight from New York to Paris by Colonel Charles Lindbergh. A visit to an airdrome will demonstrate how anxious people are to fly—both young and old. This interest and participation in travel by air affects each and every life insurance company at this time and will with increasing volume in the future, for after millions of years of two dimensional life, man has started to move and think in three dimensions.

"Railway Age," in a recent issue, contains the following conclusions in an article entitled "Air Transport Making Rapid Progress":

"It may thus be seen that the progress made during the past year has been sufficient to place commercial aviation in this country on a parity with that of Europe, and that the broad gage legislation and regulations enacted have furnished an impetus that eventually will carry it far ahead.

"Air mail and air express will shortly become an integral part of industry; their possibilities are large

and their expansion inevitable, either independently or as feeders and extensions of other means of transportation.

"As the railroads have found it necessary to adjust themselves to the competition of the motor bus, so will they in the near future find it necessary to accommodate themselves to the airplane. However, this may be to their ultimate mutual advantage and the proper tying together of three forms of transportation offers unlimited opportunity for executive ability."

You may ask in what way does this progress and interest in aviation affect us, for we will not accept anyone who has flown frequently, does fly, or intends to fly in the future—we are safeguarded by not taking this type of applicant. We were impressed with this attitude as a result of the answers secured from a large number of companies in response to a questionnaire we sent out. The interesting fact was established, however, that the policy contracts of forty-two of the fifty leaders in volume of business in force January 1, 1927, have no clause eliminating liability from aeronautical activities. The volume of business thus represented is $67,512,454,278. Four companies have a one-year elimination rider and four a two-year elimination rider so that on the volume of business two years old each and every one of the fifty leaders in the United States and Canada are covering travel by air to the extent of $73,276,680,279. We are, therefore, all interested in the rapid strides and the safe development of this means of transporation.

One other factor which will, in the near future, cause all life insurance companies to face a decision at least as to passengers over established air routes between definite points, is the action of accident com-

panies. During the past six months many have liberalized their policy contracts to cover for any loss caused by any hazard of aviation while the insured is riding as a passenger in a licensed aeroplane operated by a licensed pilot upon a regular passenger route between definitely established airports. This action has been taken on all but a few of the restricted class accident policies and is retroactive in many instances. One of the largest accident companies in the world, after a survey, found that "the hazards of regularly established and licensed aviation are little greater than those which beset pedestrians or the occupants of automobiles."

With the volume of business on our books without restriction as to the manner of travel, and the action of many accident companies with reference to their policyholders, we are faced with a problem which needs early solution.

Anything pertaining to aviation is of public interest and the news distributing agencies are always keenly aware and alert to furnish full particulars with regard to the industry. We have flare headlines of accidents and fatalities, but rarely a line of the thousands of miles flown in this country without mishap.

In an interesting article recently appearing in the "Saturday Evening Post" on the fallacies of aviation, William B. Stout states:

"The factor that finally determines the success or failure of any business enterprise is not what its owners and operators know, but what the public believes. Motor cars were running about the streets of our big cities for ten years before the average citizen was ready to trust them with his own life under his own guidance. He was willing to say they were

safe, but he was uncertain of the answers to sundry contingent questions. While he was absorbing this information by a process of observation and discussion, the pioneers of the industry were running themselves ragged in search of capital or spending sleepless nights trying to think up new stunts to dramatize the automobile. Speed, safety, endurance, reliability, economy and exclusiveness were tried singly and in combination. Then familiarity with the details of operation developed and the motor car arrived. Mechanically, it had been ready for some years before it was taken up by the public.

"Commercial aviation today is in a position exactly comparable to that occupied by the motor car makers a quarter of a century ago, with respect to public opinion and its own state of mind. Its owners and operators, in other words, know more about flying than the public believes.

"They know far more now, as a matter of fact, than automotive experts knew twenty-five years ago about the essentials of good motor car design and operation, since most of the experimental power plant work was done for them. The industry is, therefore, much farther advanced mechanically and scientifically, but in my opinion it has been ignoring the psychological lessons of the pioneer motor car days, and it is still making some of the same fundamental mistakes.

"The worst of these—the uncontrolled stunt flying and use of unsafe and outdated types, which may be classified as mistakes of commission—have now been pretty well discontinued. The big mistake of omission, however, is still being made. The public is being given the same overdose of technical information. It is being told what the engineers and designers know. Every new development is explained in detail, and hardly a day passes without some new performance achievement which is blazoned on the front pages of the newspapers. Undoubtedly there is a public interest in this sort of thing—an interest that is grow-

ing with incredible rapidity. But it is the interest of curiosity rather than of demand. It is a repetition of our experience with the motor car, and it does not answer the question in the public mind.

"As I see it, the trouble with what we have been doing is that it compares aviation with aviation, and the average citizen has not yet absorbed a knowledge of what aviation is. He knows it is safe, and every day further assurance is given him on this point. A few days ago an enthusiast with a taste for statistics announced that more people were kicked to death by mules than were killed in airplanes. This is a better comparison than some of the statistics being published, but it makes little impression on the vast majority of our population, which knows nothing about mules. The industry, in a word, is assuming that every citizen knows what every pilot takes for granted and what every school boy and girl is being taught—the things that are obvious to seasoned flying passengers even when there is no technical or scientific knowledge."

One of the factors that will influence the success of aviation in the immediate future is the attitude of the life insurance companies toward flying. Those who are responsible for the solution of the underwriting problems presented by this new industry must know what the owners and operators of the industry know and believe what every pilot takes for granted. The insurance world cannot assume anything, as sound underwriting must be based on facts. It is the purpose of this paper to outline without entering into cumbersome detail the major facts concerning safety in flying. The youth of the industry makes it difficult to collect data representing a wide experience. That which is obtainable, however, plainly indicates that certain types of flying are reasonably safe.

The aeronautic industry, no doubt, has been of the opinion that the life insurance companies have been slow in coming forth and insuring those persons engaged in the air. In this occupation where there are hazards, those interested and especially those actively engaged, are prone to minimize the hazards involved.

Rapidly and in great strides has this new mode of transportation developed; in fact, so rapidly that it has been impossible to collect data or keep abreast with all the new safety factors employed in flying. The life insurance companies, however, have been studying the flying question from its many angles and are always in search of facts concerning the industry with a view towards insuring those engaged or traveling in the air at the best possible premium.

Aviation is a broad term including the activities of all craft that travel in the air. These craft may be divided into two general classes, namely, heavier-than-air and lighter-than-air. Under the former classification are to be found airplanes, seaplanes and flying boats. Under the latter classification all types of free balloons, dirigibles, and semi-rigid balloons find their place. In this paper the authors make no attempt to consider lighter-than-air transportation, chiefly because there has been very little done commercially in this line. It will also be found that there is no distinction made between the three classes of heavier-than-air craft. A number of the companies from which data was obtained in the composition of this paper operate all three types of heavier-than-air craft.

Flying as done today may be divided, for the sake of convenience, into six types, although there might

be only two main divisions; namely, military and commercial. It is of the greatest importance in considering the question of Life Insurance and Aviation to study carefully the various hazards to be found in each of the six types of flying. The first of these, military flying, in one respect is possibly the safest, but on the other hand, probably the most hazardous. It is safest from the standpoint of ground organization in that labor conditions do not enter into the maintenance of the flying equipment, which makes it possible at all times to have sufficient skilled mechanics to care for the ship, parachutes, etc., that insure safety in the air. The pilots in the military service are most carefully selected. In fact, out of every hundred applicants to the Army School of Flying only twenty-five are selected to begin their courses as cadets. A further drastic reduction is made as these cadets progress in their courses so that only one out of every six of those who start graduate as pilots. These men, however, are pilots of the first class with a thorough training in every branch of the industry. The military service also has the great advantage of keeping constantly under supervision the men who fly.

On the other hand, the missions carried out by the military pilot are in many instances hazardous. It is part of their training and daily routine to engage in aerobatics. A great deal of flying done is of experimental nature. Military flying, of course, is done in every climate and at all altitudes. Whether or not the hazards of flying are offset by the excellent equipment and pilot under military flying is a question.

Commercial flying is that which must receive promptly a great deal of attention. In view of the

fact that we in the insurance world must face this problem squarely, it behooves us to make a study of the five types of flying making up this second great division. Purely commercial flying should be thought of as that type which is done over defined routes and under the control of reliable companies. It should pertain to those ships that carry regularly mail, express, freight and passengers between given points. This type of flying, taking all factors into consideration, is probably the safest that is done today. There are about twenty-seven good companies operating aircraft over regularly prescribed routes. These companies, with one accord, seem to place the first and last emphasis on safety in the air. The night traveling is done chiefly over lighted airways. The airways themselves are made up of numerous landing fields and the ground organization is supervized with great care. In this class of flying are placed the air mail contracts.

Manufacturing and testing is a third type of flying that must not be overlooked by the insurance companies in view of the fact that the individuals engaged in this business might very easily obtain insurance without the application presenting any of the facts that would relate to flying. The testing of planes is that part of flying that probably is the most hazardous of all. It is experimental. True enough, all individuals who are doing test work are equipped with parachutes but even at the best this is a dangerous phase of the industry.

Barnstorming, or gypsy flying, as it is sometimes called, is that type where an individual with a single ship will fly from town to town carrying passengers

from any available field for a certain price per ride. This type of flying is gradually becoming obsolete, but it was this kind of flyer who pioneered our present day commercial work. To him can be attributed a good percentage of the mortality as seen in commercial aviation since 1919. It is perfectly obvious that he did not have, nor does he have today, the advantages of that ground organization that is necessary to keep both flyer and plane fit to fly. Until the recent Air Commerce Act went into effect this type of flyer operated unrestricted in every phase of his work. Today, however, he is largely restricted by law.

Private flying is just as its name implies. It may be participation on the part of the individual who owns the ship or an individual may own the ship and engage a pilot to fly it for him. Unless this aircraft is regularly quartered on a good field where all the advantages of first-class ground organization are to be had, it is a dangerous part of flying. In issuing insurance to such an individual, a company should certainly know whether or not such a ship is constantly under the supervision of such a ground organization and whether the pilot is periodically checked in accordance with the Air Commerce Act.

Exhibition flying is that type where the airplane is made use of to advertise, in one way or another, any or all kinds of products. It may be done by radio from the air, electric lights on the plane, fireworks from the plane or sky-writing. The question of ground organization and supervision of the pilot enters in here as well, but in order that the advertisements be brought conspicuously before the public, it is necessary to take some chances. Possibly the safest of

this exhibition flying is sky-writing. From an insurance standpoint exhibition flying probably is safer than manufacturing, testing, barnstorming or private flying because most of it is done by companies which are sufficiently organized to supervise carefully the ground organization and the pilot.

Finally, there is a class of flying which is difficult to place in any one of the five types already mentioned and which for the sake of classification might be placed in the category of commercial flying. This class embraces the forestry patrol, aerial photography, dusting, and news work for the moving picture industry. A study of data obtained from companies doing this type of work reveals their experience to have been remarkably free from fatalities and casualties. Most of the data collected is compiled from figures reaching back to 1920.

The Development of Aviation

The development of aviation is thought by some to be slow, but in analyzing the march of progress one must marvel at the strides which the industry has made considering the field of operation. In the case of every one of its predecessors, save marine transportation, the industry developed as it were in the midst of the population, while the sea and the air have written their story where human life does not normally exist. This has, no doubt, had its effect in retarding the growth of flying, but if anyone doubts that aviation must grow rapidly and far beyond the expectation of even the most ardent enthusiast, let him pause long enough to look back over the ages. He will find that civilization has progressed only as fast

as its means of transportation and communication, and that at the present time it is clamoring for even swifter methods. Aerial transportation, therefore, must supply this demand.

There is an inherent tendency for the human being to remain on the ground; not being born to fly, he is distinctly out of his element when in the air. To master enough courage to go for the first time into the air is a problem. In fact, it is a problem which he is very likely to put off as long as possible, for the necessity of solution does not influence his daily life one way or the other at the present time. However, when he has gone into the air for the first time, he still speculates as to why the plane remains aloft. A very large part of the population today is not versed in the physical laws which make flying possible. The old adage of "whatever goes up must come down" sounds perfectly reasonable to the average lay mind. The public does not grasp the idea that great speed plus curved surfaces tilted at the right angle cause the air to approach solidity underneath the aircraft while that above still remains rare, thereby causing what is known technically as lift. By the same token, the identical physical laws that are operative in lifting the plane also enter into landing it safely.

In spite of the fact, however, that the public does not understand the aerodynamic principles, it is accepting more and more every day the results of these principles as established facts as they see the successful demonstration of the airplane many, many times, so that the industry has within the past year, and more particularly within the past six months, taken a real forward spurt. There is not that dramatic atmosphere that there was before, during and after the

war, but as one looks over the field now, the whole industry has taken on a businesslike attitude. Possibly one of the greatest indications of the public interest in flying at this writing is the fact that airplane distributors are having great difficulty all over the country in making deliveries on their orders. There certainly is a great dearth in the output of heavier-than-aircraft. This, no doubt, is the result of two things: First, because of recent federal legislation. Great numbers of antique aircraft, which were largely responsible for many of the past fatalities, are being relegated to the past, being placed on scrap heaps and in museums. To take their place new craft are needed and are being supplied in sufficient numbers only with difficulty. In the second place, public interest and demand have grown tremendously within a short period of time. This condition, however, may be considered a healthy condition if a high standard of production is maintained in the face of the demand.

There are today in this country under operation over 9,000 miles of airway. Every single mile, except the model airways which are operated by the United States Army, is being operated by private capital. This is in striking contrast to the condition abroad where flying is largely a matter of government subsidy. Let us look for a moment at more indications of how this industry has grown to the present time. In the Aeronautic Trade Directory, Information Booklet No. 3, second edition, Department of Commerce, Aeronautic Branch, is to be found listed eighty airplane manufacturing concerns, sixty-six airplane distributors, thirteen aircraft engine manufacturers, thirty-seven aerial advertising companies, sixteen airway operators who are operating air mail contracts,

and three hundred fifty-seven air service operators who are operating taxi, passenger and express services but not on scheduled routes. As its name implies, this group includes taxi service. It carries individuals for pleasure, sight-seeing, unscheduled business trips, etc., and is not to be lost sight of from an insurance standpoint. Continuing then, we find twenty-four concerns doing exhibition flying and one hundred sixty-six institutions of all kinds giving instruction in flying and ground work. In addition to the foregoing, it is exceedingly interesting to note that seven of our leading universities are now teaching aeronautic as a separate branch of engineering and that the industry supports nine publications. This is only a glance at the industry for there are many other phases of it which have caused much manufacturing to be done, and many concerns have sprung up which have heretofore been unknown, which concerns manufacture many of the spare parts and accessories. Finally, one large fund, the Daniel Guggenheim fund, has been created solely for the scientific advancement of aeronautics.

There are many more definite indications of a rapidly developing industry set forth by the following facts: There were sixty-six station stops on the 1926 routes serving eighty-four cities with a population of nearly 24,000,000. Over $5,000,000 was invested in the contract airway system by air mail contractors in 1926. This sum has been rapidly increased up to the present writing. Nearly $17,500,000 was estimated to represent the value of real estate and improvements at the sixty-six airports mentioned above. Up to June 30, 1927, 4,121 miles of airway lighting has been installed. On September 1 of this year there

were twenty-four mail airways in operation serving 65,677,209 people with seventy-one station stops. Over these lines passengers are transported as well as mail.

Flying is becoming much safer. A study of the data compiled by the United States Air Mail Service reveals this to be true. The conclusions drawn can be applied to all flying in general when done under the same conditions and in accordance with the Air Commerce Act of 1926. The Transcontinental Air Mail Route is the finest example of flying in the world today and, therefore, the figures as compiled from the operation of this system since 1919 are certainly significant. A glance at the accompanying chart will tell the story.

-: U.S. Air Mail :-

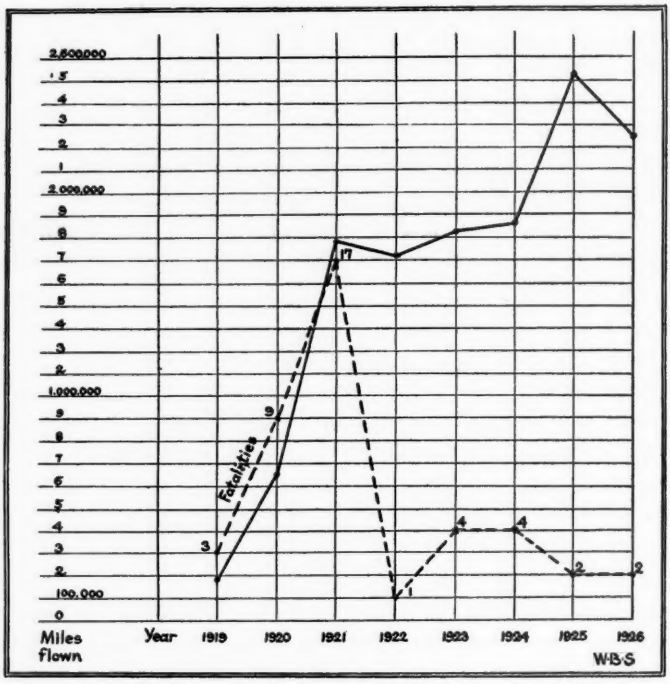


Chart showing a comparison of miles flown and fatality per mile over the U.S. Air Mail Route from 1919 to January 1, 1927. The data compiled is the most reliable that can be obtained today

Chambers of Commerce in every city and town in this country today are mindful of the fact that new modes of travel have a vital effect on any community. Consequently, a Committee on Aeronautics is being incorporated almost without exception in every municipality where a Chamber of Commerce body exists. Interest in airports is at a fervent heat and municipalities realize that airports mean just as much to a community as do good roads. Railway companies are seriously considering supplementing their passenger and express service by airplanes. Assistant Secretary of Commerce, Mr. William P. McCracken, Jr., has recently stated that five of the larger railway systems in the country have requested data of this Department for the express purpose of arranging to carry out an aerial program. The American Railway Express has already inaugurated regular transportation by air. It is not an uncommon thing nowadays for large companies to own their own airplanes in which their officials are enabled to travel over wide stretches of territory, thereby saving much time and, consequently, expense. One prominent oil company recently purchased an aircraft to carry its directors about, and it was found that about $16,000 per year was to be saved by this one investment.

We in the insurance world are especially interested, of course, in the number of people who travel by air. In studying the development of aviation some exceedingly interesting figures are to be found in the reports of the Aeronautical Chamber of Commerce of America, Inc., for 1925 and 1926:

"The past year has seen a very considerable increase in the number of commercial aircraft operators. In 1925 the Aeronautical Chamber of Commerce

obtained reports from two hundred ninety operators, whereas this year four hundred twenty reports have been received. Operators reported owning six hundred seventy-six airplanes in 1925, whereas the past year nine hundred sixty-nine commercial aircraft were reported in operation in aerial service work. These operators and their machines are scattered throughout the entire country from the Atlantic to the Pacific, and from Alaska to Mexico.

"Looking into the statistics closely it is apparent that the past year has witnessed what may be a more economical and businesslike operation of commercial aircraft. The number of passengers reported increased from 205,094 in 1925 to 380,201 in 1926. In addition to the passengers, 182,508 pounds of express matter were carried during 1926 by commercial aircraft operators. The total mileage reported for the year was 7,656,492, irrespective, as are all these statistics, of air mail operation over regular routes."

We have in the previous paragraphs and by the chart shown that mileage has tremendously increased over the Transcontinental Airway since 1919, while fatality per mile has gone equally as far in the opposite direction. In the preparation of this paper data was obtained from a number of the largest and most representative operating companies in this country. A resumé of this data is set forth here believing as we do that it has direct bearing on some of the underwriting problems.

Company No. 1 operates 700 miles of airway, carries passengers, has flown 675,000 miles since January 1, 1925. One fatality is reported in the case of a pilot operating in direct disobedience to orders.

Company No. 2 operates 1,735 miles of airway, flies 5,000 miles per day and carries passengers. Since May, 1925, 1,000 passenger miles were flown without

the loss of a plane, pilot, passenger or any part of the cargo.

Company No. 3, while not operating an airway of its own and carrying nothing but passengers, has flown since January 1, 1925, 50,000 miles and carried during 1926, 5,616 passengers without a casualty or fatality.

Company No. 4 unfortunately does not give us the mileage nor does it operate a regular airway. It has, however, flown 20,000 hours and reports 4 fatalities.

Company No. 5 operates an airway of 660 miles and reports data covering a period from April to December, 1926. 328,892 miles were flown and 258 passengers carried. No fatalities.

Company No. 6 operates 1,099 miles of airway and reports having carried 102 passengers between September 15 and December 31, 1926 without a fatality.

Company No. 7 began its operations April 1, 1926. It reports that for the last nine months of 1926 it flew 259,924 miles and carried 939 passengers exclusive of the company's employees. There was not a single accident during that time.

Company No. 8 operates 199 miles of airway and during 1926 100,000 miles were flown and 2,000 passengers carried exclusive of pilots. Unfortunately casualties and fatalities were not recorded.

Company No. 9. During 1926 this company operated an air line between Philadelphia and Washington, D. C., in conjunction with the Sesqui-Centennial at Philadelphia. During the five months of its operation 3,695 passengers were transported and 93,770 miles were flown without a casualty, fatality, or even a minor mechanical failure. This company ceased its operation when the Sesqui-Centennial closed.

These companies stated that the qualifications for a

position as pilot were the satisfying of the requisites of the Air Commerce Act of 1926. To quote from one of these companies:

"Minimum requirements for our pilots are 500 hours of flying on different types of airplanes and at least half of this flying must have been night flying. Although this is the minimum requirement, we do not give much consideration to pilots with less than approximately 1500 hours and all pilots whom we have in our employ at the present time have over approximately 2800 to 4000 hours of flying and under all possible weather conditions, both day and night."

The above is without a doubt a classical example of the great care used by reliable companies in commercial aviation in selecting their pilots.

In outlining the development of this industry the task would not be complete without mentioning the uses to which the airplane has been put besides those already discussed. For the sake of convenience we might term these activities as aerial service. Under this heading many broad fields have been opened up and no doubt a number of the life insurance companies have already received applications for Group Insurance covering some of these fields. This group has already been mentioned elsewhere in this paper and includes taxi service, aerial photography, dusting, mapping and survey, forestry patrol, relief expeditions and explorations. In addition, a number of large manufacturing companies have already instituted their own aerial freight services. It is with satisfaction that we can state that there is more diversified flying done in the United States than in any other country in the world.

AIR MAIL SERVICE—STATISTICS

Fiscal Year	Miles Mail Trips Scheduled	Miles Traveled with Mail	Percentage Miles Flown with Mail	Number Letters Carried (40 per pound)	Total Miles Ferry & Test Flown, Mail,	Mech. Forced	Weather Landings	Fatalities Number	Average Miles Flown for each Fatality	Number Minor	Injured Serious	Planes Crashed per	Average Miles Flown Crash
1918	18,000	16,009	84.	713,240	21,389	6	6	0	No fatality	0	0	0	
1919	166,843	160,066	96.	9,210,040	194,986	37	56	Total 8 2 pilots 1 on ground	64,995 97,493 194,986	2	1-flight	13	14,999
1920	653,764	549,244	84.	21,063,120	648,400	155	105	Total 9 5 pilots 4 passengers	72,044 129,680 162,100	12	1-flight 1-ground	33	19,648
1921	1,819,987	1,554,985	86.	44,834,080	1,770,658	810	954	Total 17 12 pilots 1 on ground 4 passengers	104,156 147,554 442,664 1,770,658	33	1-flight 2-ground	56	31,618
1922	1,629,250	1,537,927	94.	48,988,920	1,727,265	281	479	Total 1 1 pilot	1,727,265	33	1-flight 3-ground	17	101,604
1923	1,644,457	1,590,637	96.	67,875,840	1,809,028	176	279	Total 4 3 pilots 1 passenger	452,257 603,009 1,809,028	27	2-ground	12	150,752
1924	1,590,425	1,522,763	95.	60,001,360	1,853,251	154	353	Total 4 4 pilots	463,312	41	1-flight 5-ground	14	132,375
1925	2,160,022	2,076,764	96.	9,300,520*	2,501,555	174	586	Total 2 2 pilots	1,250,777	46	2-flight 3-ground	12	208,463
1926	2,405,059	2,256,137	94.	14,145,640*	2,547,992	155	707	Total 2 2 pilots	1,273,996	59	2-flight	9	283,111
1927	2,482,865	2,329,553	95.	22,385,000*	2,583,006	140	881	Total 1 1 pilot	2,583,006	51	2-flight 9-ground	33	78,272
Total	14,570,663	13,594,085	93.	298,517,760	15,657,530	2088	4406					199	78,681

*Only mail with postage prepaid at the higher or special air mail rate was carried in 1925, 1926, 1927.

32 fatal crashes
32 pilots and 9 employees who accompanied pilots on flights killed. 2 employees killed on ground by propeller

Average for each crash 489,305. Average for each employee killed in flight 381,896. Average miles for each fatality (flight and ground) 364,134.

Safety Factors

In the final analysis of the relationship between Aviation and Life Insurance the important things to consider are those agencies which control the safety factors. The mortality experience of the industry will vary in direct proportion to the efficiency of these agencies. The safety of any flying, no matter where it is done, depends entirely on the efficiency of the ground organization behind such flying. There are four major topics to be discussed under the heading "Safety Factors"; namely, the pilot, the aircraft, the airway and the existing laws that govern flying in this country.

The first and most important is the pilot. After all, there may be mechanical failures or difficult airways over which to fly or other emergencies of greater or less importance; but if the controlling hand remains steady and the judgment clear, many a disaster can be avoided. We have in the pilot, however, an agency that is difficult to inspect. Mechanically the aircraft can be dissembled and its most remote parts examined for flaws, but with the pilot the inspection is not so easy. His inspection today, however, is quite complete and reasonably accurate. That department of the industry, whether military or commercial, that selects the pilot, cares for him and classifies him is known as Aviation Medicine.

This specialty had its beginnings during the war. The British found during the first year of the World War that of every hundred aviators killed, two met death at the hands of Germans, eight because of defective planes or motors and ninety were killed due to their own individual deficiencies. Of these ninety,

sixty were found to be due directly to physical defects. As a result of this startling discovery the British established a special Care-of-the-Flyer Service and their aviators were selected with due regard to their qualifications. As a result, at the end of the second year their fatalities due to physical defects were reduced from sixty to twenty, and at the end of the third year the still further reduction had been made from twenty to twelve. In the military service practically every country now requires a special physical standard for its aviators.

In the analysis of the casualty record for 1925 with reference to commercial aviation it was found that the total number of accidents was one hundred twelve, the number of persons killed eighty-three, and the number of persons injured one hundred twelve. Of these one hundred twelve accidents, thirty-four were attributed to error in piloting. Just what part of this number may have been due to physical defects will never be known, of course, but it should be definitely borne in mind that when the term "physical requirements" is used, it is meant to include mental requirements as well. It is, therefore, very necessary that we carefully scan mentally and physically those to whom the public are to entrust their lives.

Today both commercial and military flying supervises its pilots by the application of aviation medicine, even though the tests applied are somewhat different under these two divisions of flying. Fundamentally, they are alike. There is nothing new medically to be found in the system of aviation medicine. It is the correlation of the various specialties into a system which when applied to an individual by one trained in its application will bring out such defects as would

be detrimental to safe and sane flying. Those who practice aviation medicine are known as Flight Surgeons under the military regime and as Medical Examiners under the Department of Commerce. Those who practice this specialty military-wise are required to receive their instruction at the School of Aviation Medicine located at the Army Flying School, Brooks Field, Texas. The Department of Commerce for commercial work makes every effort to select the graduate of this school when he is found in civil life. The Department realizes, however, that this is not always possible. Consequently, a correspondence course has been devised when it is necessary to train physicians other than military men for this work. The resident course at the Army School requires three and a half months during which time an excellent training is given in the examination of the eye, ear, nose and throat, heart and lungs and nervous system to which is added a thorough course in psychiatry.

A great deal of stress is laid on the study of the mind and the nervous system of the man who is to fly. The tests are exhaustive, but it is positively essential that the one safety factor on which we rely must be as nearly perfect as it is possible to find it. A great deal of emphasis is laid on the findings in the eye. Vision must be perfect. The field of vision must show no abnormalities. The amount of muscle imbalance acceptable is exceedingly small and the depth of perception must not exceed thirty millimeters. The eyegrounds must show no abnormalities and the remaining inspection of the eye must accord correspondingly.

The personality study of each applicant for flying is made with thoroughness, as it is necessary to search

the life history of each one of these individuals to pick out, if possible, any indications, either familial or personal, of an underlying unstable nervous system. It is not the purpose of this department of aviation to seek the superhuman individual but it is absolutely necessary that the individual selected to fly must be as nearly 100% normal as it is possible to find him.

The function of this department is threefold. First, it must select the man who is to fly. It then is under obligation to supervise his physical and mental care and thirdly, to classify him. We have already outlined the items of examination which result in his selection. The care of the flyer is of the utmost importance and can only be accomplished by a certain intimacy between the Flight Surgeon or Medical Examiner and the flyer himself. He must know his habits and haunts and must carefully study him as every opportunity presents itself. In commercial work it is more difficult to carry out this program than under the military plan, but nevertheless, it is perfectly possible and is accomplished by the selecting of a Medical Examiner having limited territory whereby he becomes familiar with just those men who fly in that area and are examined by him. When the Examiner notices any departure from the normal in any flyer, be that departure ever so slight, it is his duty to take the flyer out of the air temporarily or permanently, as the case may be, make a study of him, correct any defect that may have presented itself and then to return him to the air again for duty, if in his opinion such defect has not permanently disqualified him for flying. It is the further duty of this department to make such suggestions to flyers as will preserve their health both physically and mentally and in every way co-operate with them in

leading the life that will fit them for the nerve-draining duty which is theirs in the air.

As to the classification of the flyer, this is not so necessary in commercial aviation but is of the greatest importance in military flying and, therefore, does not need be given much space. It simply refers to classifying men as to their ability to fly in high altitudes. Some individuals cannot fly over 5,000 to 8,000 feet without being affected by the change in oxygen pressure. There are also some who cannot fly over 10,000 to 15,000 feet while many of them fly to an unlimited ceiling. It can be readily seen that to send an individual on a mission in the air that requires flying 10,000 feet when he physically can fly only 5,000 feet would be certain disaster. Through a rather complicated system, the United States Army Air Service at its larger flying centers, classifies its flyers.

The Department of Aviation Medicine is also responsible for the designing and procuring of the proper clothing and goggles for the flying personnel and in addition makes a study of those diseases peculiar to the industry.

Aircraft

Next to the consideration of the pilot, a study of the ship, its power plant, and construction is necessary safety in flying. The advancement in aeronautic power to better understand those things which make for plants has been remarkable in the past two years. Until very recently the life of an engine before overhauling was from fifty to one hundred hours but through the development in this direction the life of an engine has been lengthened to two hundred fifty

hours. At the end of this time it is necessary to completely overhaul the power plant. Think what it meant only a few years ago to entrust human life to an engine whose life was at the very best one hundred hours. It took the first ten to fifteen hours of its life to break it in and soon it was approaching its limit of safety so that the actual time that an engine could be relied upon was only a matter of a few hours of its entire life between overhauls.

The second great step has been the advancement in cooling. Until two years ago practically all engines were water-cooled, but today the air-cooled engine is taking precedence over the water-cooled type. This means a great deal in the designing and flying of airplanes. There is not the everready leak in the cooling system nor need care be exercised particularly in order not to freeze the cooling mixture. These points are of only minor interest, however, when taking into consideration the great amount of space and weight saved for other purposes when the air-cooled engine is used. In fact, the air-cooled power plant today is capable of developing approximately one horsepower for every one and one-half pounds of engine weight. Recently a very prominent manufacturer in the industry stated that aviation was presented with the internal combustion engines already developed, whereas the automobile industry found it necessary to develop its engine before the automobile could advance. As true as this may seem, nevertheless, there has been approximately as much work done in developing and applying the internal combustion engine in aeronautics as there was in developing the internal combustion engine for the automobile. The power plant today is one which affords greater en-

durance and reliability than did its ancestors two years ago. The motor is a most vital part of the aeronautic industry. Had it not been for the great development along these lines, the transoceanic flights would never have been possible. Therefore, with three such engines in any one plane, it is not at all difficult for even those who know least about the industry to comprehend the safety factor added to flying in just this one respect.

Then comes the plane itself. There have been many advancements made in the design and construction of aircraft. Monoplanes, biplanes and triplanes make up the different designs which more or less follow individual ideas of the designers and manufacturers. Practically all of the planes designed today embody the fundamental factors of safety. Some idea can be had of the variance and difference of opinion in the construction of aircraft when it is realized that there are about eighty manufacturers of planes in this country today. The situation is almost as bad as it is in the automobile industry in this respect. There are, however, certain features in airplane construction which make a very definite impression on the factor of safety in the air. The majority of planes have steel or metal framework. This eliminates the question of dry rot which used to be experienced in the old wooden structures. It also makes a more rigid frame. Should the plane perchance crash on landing, the rigidity obtained by the steel construction would certainly avert disaster in many instances. There is the same comparison between the metal construction in planes today and the old wooden construction of yesterday, as there was a few years ago when wooden passenger coaches were discarded for steel ones.

The undercarriage or landing gear shows a decided improvement. The wheels are set farther apart and instead of a crossbar connecting the two wheels in a horizontal fashion, there is the open landing gear. The main support is obtained by diagonal rods from the bottom of the body to the axle of the wheel on either side, leaving an open space between the wheels so that a plane may safely land on rough ground without catching or damaging the landing gear or upsetting the plane. A great many planes still have a tail skid which is that part on which the tail lands and is dragged over the ground. This causes braking force to the progress of the plane and brings it to a stop in a comparatively few feet, depending, of course, on the landing speed. There has been a great deal of advancement in this line as well, for today selective brakes are placed on the wheels; selective because the brakes may be applied independently of one or the other and the plane may be stopped safely within a very reasonable distance. By selecting the brakes it not only may be stopped quickly, but also turned around. The old tail skid idea is about to give way to this new arrangement of things. This will, no doubt, arouse the question as to the plane tipping over on its nose when retarded by its brakes. The answer is found in another decided change in airplane design and construction. Today most planes are built with the landing gear well forward so that the greatest percentage of the weight of the plane falls behind the center of gravity passing through the landing gear. This insures the plane against tipping over on its nose, as so many of its ancestors were wont to do.

The multimotored plane has added and will con-

tinue to add much to the safety in flying. There seems to be some slight question in the minds of authorities in the industry as to the economy of carrying three engines on one plane. Some think that the payload carried by three motors would be entirely too great to be carried by two motors, should there be a motor failure. It is the greatest percentage of opinion, however, of those interested in construction and design that the first factor to be considered in commercial ships is the safety factor and that the payload capacity for any multimotored ship should not exceed that which two motors could successfully carry once the load was in the air. It is always necessary to have the maximum of power to get a maximum payload off the ground. Obviously, then, the three-motored ship will, no doubt, afford the greatest amount of safety. Some of the minor factors that should be mentioned, and which add to the safety of flying so far as aircraft construction is concerned, are the metal propeller, the improved instruments and instrument board, the several developments which add much stability to the commercial plane and the designs which allow for the greatest visibility in all directions and also protection to the pilot from the elements. A word regarding the difference between all-metal ships and those covered by fabric will not be out of place. Some debate exists today over this question but probably there is a great deal to be said on both sides. The question of eliminating a fire hazard which might result from the fabric absorbing gasoline and oils is eliminated in the metal covered ship, but the metal covered ship will outlast the fabric covered one many times. A metal covered ship makes it unnecessary to expose the framework occasionally for re-covering so

that an inspection of the famework which is necessary might be overlooked in the metal covered ship, whereas the opportunity presents itself every time the fabric covered ship is re-covered. No unanimous opinion exists concerning this question so that it is impossible to make any definite conclusions at this writing. Even though the pilot is carefully inspected and the airplane well constructed, without very efficient ship inspection safety in the air would be a comedy. It is positively necessary to have the best organization on the ground to care for the ship. Every time a plane lands after having completed a mission, it is thoroughly inspected from engine to tail. Every wire, every turnbuckle, all joints and connections are thoroughly gone over. In addition to this, the plane is promptly serviced, which means that the oil is inspected and the gas tanks filled with fuel. The balloon tires are brought up to proper pressure. Any company that does not follow this system in every detail is not attending to the safety factors, but every good company operating today does just this thing. Not only is it necessary to keep the strictest vigilance over the ships, but it is necessary to keep a record of the engine time so that the life of the power plant is not overlived. When the life of an engine is spent, the engine is overhauled.

The Parachute

For the sake of completeness, one safety factor must be mentioned which has many times proved its efficiency but as yet has not been in general use commercially. This is the parachute. It is the opinion of several authorities that the day will come when every passenger will wear a parachute, just as law compels

every operator of watercraft to supply life preservers for every individual transported. There are two good reasons why parachutes are not worn today by air passengers. First, they are quite clumsy and second, very expensive. There are three kinds; namely, the chest chute, seat pack and back chute. Any one of these takes up space and adds more or less discomfort. The average parachute today costs approximately $600. This instrument of safety is exceedingly efficient when used at the proper altitude. Under 1500 feet they are not of much use but anywhere above that limit they have not been known to fail when properly operated. The military service requires every occupant of a military aircraft to wear a parachute. Outside of the military service they are in general use among test pilots and those executing missions of experimentation.

Airways

It is quite necessary, of course, when a ship has gone into the air that it come down again sometime and somewhere. No matter what the circumstances may be surrounding its landing, if a safe place has been provided for its landing the flying becomes safe. An airway, contrary to the picture it might convey, is not located in the air at all but is the terrain over which a plane passes from one given point to another, providing that route is defined. The airway consists of a series of landing fields. Those located in or near cities are usually airports. Airports are equipped for housing, fueling and repairing planes.

It is of added interest in writing of airways and intermediate fields to study the following information

which appears in the September issue of the United States Air Services.

By the end of 1927 about 1,000 airports and intermediate fields will dot the United States from coast to coast and from the Canadian border to the Gulf of Mexico, according to a survey of airway facilities made by the Department of Commerce at the instigation of William P. MacCracken, Jr., Assistant Secretary for Aeronautics. During the past year more than 50 new airports have been established and twice that number of cities have set aside funds or have begun plans for modern terminals. Chambers of Commerce, business clubs and other civic organizations are co-operating in the effort to build up a complete airway and airport system. The present 864 fields include 207 municipal, 163 commercial and private airports, 124 Department of Commerce intermediate fields, 287 miscellaneous intermediate fields and 81 Army, Navy and National Guard fields, one Treasury and one Agricultural field. By the end of the fiscal year of 1928 the Department of Commerce estimates that lighted and marked intermediate fields will total about 262 compared with 124 at the present time. Besides these the Department has on record about 3,000 unimproved fields such as pastures or similar areas throughout the country on which landings and take-offs have been or can be made. Those things which constitute a modern landing field, particularly of the airport type, are, of course, designed for safety. The field is as nearly square as possible with runways of not less than 2,000 feet. The surface is level and without ruts. The approaches to the field are cleared of trees or other obstacles projecting into the air or if they cannot be removed, they are conspicuously marked by day

and night. On one corner there is a windvane which can be seen readily from 3,000 feet in the air. The borders are well lighted at night by incandescent lamps and in some cases the safer approaches are marked by green lights while the more hazardous ones by red. The windvane is lighted at night. On the larger fields will be found floodlights, flooding the field with light when a plane is about to land. In addition to the things already mentioned, on a modern field today are to be found large fireproof hangars in which to store ships, filling stations and oil supplies together with a meteorological station where weather reports can readily be obtained. There are also available skilled mechanics for repairs and spare parts for the planes.

In addition to the lighting of the field, there is the lighting of the airway. This is done by revolving beacons placed at varying distances apart, depending upon the particular topography and prevailing atmospheric conditions of the airway. The interesting feature to be noted in connection with these beacons is the elimination of the human element in their operations. They are operated by a lightswitch which automatically turns the light on and starts the beacon revolving just as soon as daylight has faded to 60%. There are two lights in each beacon so that when one fails the other automatically lights and is placed in focus. Some of these beacons derive their energy from gas while others from electricity. A patrol passes along the airway inspecting these lights from time to time. Over the transcontinental route almost all the intermediate fields are designated by beacons and in addition the borders of the field are outlined by incandescent lamps.

The question now presents itself as to how many fields and how far apart on any given airway. There is no standard set for the number of fields. They are placed wherever it is possible to lay them out but the larger intermediate fields on the transcontinental route are approximately thirty miles apart while smaller emergency fields are to be found between them at about a distance of every five miles. In view of the fact that a plane under ordinary circumstances can glide over a distance from seven to ten times its height in the air, there should be very little difficulty in landing a plane on a safe plot of ground over a well constructed airway, should the pilot find it of necessity to do so.

AIRWAYS OF THE UNITED STATES. No. 1, Boston-New York Colonial Air Transport; No. 2, Chicago-St. Louis, Robertson Aircraft Corp.; No. 3, Chicago-Dallas, National Air Transport; No. 4, San Francisco-Los Angeles, Western Express; No. 5, Pasco-Elko, Wilbur T. Varney; No. 6, Detroit-Cleveland, Ford Motor Company; No. 7, Detroit-Chicago, Stout Air Lines; No. 8, Seattle-Los Angeles, Pacific Air Transport; No. 9, Chicago-Twin Cities, Northwest Airways; No. 10, Atlanta-Miami, Florida Airways; No. 11, Cleveland-Pittsburgh, Clifford Ball; No. 12, Cheyenne-Pueblo, Colorado Airways; No. 13, Seattle-Portland, Pacific Air Transport; No. 14, New York-Chicago (Night), National Air Transport; No. 15, Cleveland-Louisville, Lease Aircraft Corp.; No. 16, Detroit-Grand Rapids, Stout Air Service; No. 17, New York-Atlanta, Pitcairn Aviation; No. 18, New York-Chicago (Day), National Air Transport; No. 19, New York-Chicago (Night), National Air Transport; No. 20, Chicago-San Francisco, Boeing-Hubbard

Instruments of Precision

The advancement in all types of instruments of precision has been extremely remarkable in the past two years. Fog has probably been the greatest enemy of the aviator and engineers have been constantly in search of some means of penetrating fog banks with light or electricity. In fact, when this obstacle is surmounted, flying will be the swiftest and safest mode of travel.

Much of an experimental nature has been done recently with the Neon light. This is a substance which emits rays which are reputed to penetrate the thickest fog banks. Conclusive results have not as yet been obtained so that little space need be given to this particular instrument. Suffice it to state that the results have been encouraging.

In order to pursue a given course and arrive safely at a destination, the pilot must first know that he is on his course and how far he has traveled over the course. It is impossible in the air to know how far he has traveled unless he be in a position to check his bearings on the ground. Even though he may be flying directly on his course, head winds may be checking seriously his progress so that at the end of the given time he may only have gone one-third or one-half as far as he thinks he has. Therefore, three instruments have been developed in order that he may have accurate information regarding his bearings. The first is the lead cable, an instrument which has not as yet been put into practice, but apparently has worked successfully in the experimental stage. This consists of a cable laid along the ground which constitutes the airway, the cable reaching from one land-

ing field to the next. It is charged with electricity. On the dashboard of the plane are two lights, one on the right or starboard light and the other on the left or port light. As the pilot flies along the course, even though his view of the ground is obstructed, the lights on the dashboard are lighted and so long as he flies over the cable, are of equal intensity. This is an electrical induction instrument. Should the pilot deviate from his course, either to the right or left, the light on the side to which he has deviated will become of less intensity and grow less as the pilot leaves the course. In order, therefore, that he may regain the course, he brings the plane back until the two lights are again of equal intensity. Another instrument which has been used more than the lead cable and which has apparently proved its value and is in service today is the radio beacon. It is of added interest to know that this instrument was used in the successful transpacific flight by the Army trimotored plane. The arrangement on the dashboard of the ship is practically the same as that used with the lead cable. On two landing fields approximately two hundred miles apart are placed the radio beacons which are sending stations, each emitting a ray which passes to the other station along the airway. The operation from the standpoint of the ship is the same as in the case of the lead cable.

The above instruments make it possible, with comparative ease, to safely navigate a course when the pilot is unable to see the ground. The knowledge of how far he has progressed in a given length of time is only made possible by another instrument of recent development. By means of a receiving set in the plane, and earphones which are built into the pilot's

helmet, he is enabled to receive signals from stations on the ground. Over the transcontinental airway every so far and on given fields which are numbered, are located radio sending stations. These radio stations broadcast constantly and automatically the number of the field on which they are respectively located. The fields are numbered 1, 2, 3, etc., and are so designated on a map which the pilot has before him on his chart board. As he passes along the course and receives the signals from the various stations, he knows precisely where he is when any one signal is received with maximum intensity. Not only does he know that he is on his course, but he knows how far along his course he has progressed in a given length of time. This is the second radio instrument of four to be described as instruments used in radio directing.

The next two instruments, while not having reached their full development at this writing, have been found practical enough so that within the next year it is to be fully expected they will be adding their bit to the safety of flying. The first of these is another section of the radio equipment in the plane whereby a pilot can tell when he is within the four boundaries of a given field, even though his view of the ground be obstructed. If he knows that he is within the boundaries of a field over which he is circling, there is but one more hazardous duty before completing his mission, that is, landing. Even though the fog may extend to the very ground surface, the last instrument to be mentioned eliminates the dangers of landing by indicating to the pilot in feet exactly how far above the ground he is. It is a radio induction instrument and registers with extreme accuracy. It

has, therefore, been shown that a pilot can safely take off from the field today in a heavy fog or run into a heavy fog after he has taken off, fly safely along the course, knowing at all times where he is, pick out the definite field on which he desires to land, know that he is within its boundaries and land safely without ever seeing its surface. These four instruments just described to be found in the plane are contained neatly in a small box on the dashboard, making the arrangement very compact and not cluttering up an already full instrument board.

For the sake of completeness the authors believe a short description of the other instruments that are indispensable in navigating a ship under all circumstances is necessary. They are those for altitude, speed, direction and power plant. Space does not allow entering into detail in a description of these instruments. Suffice it to say that altitude instruments are those which show at any time how high in hundreds of feet the ship is in the air with reference either to sea level or to the field from which the ship has taken off. In addition to this, an instrument known as the barograph not only shows how high the ship is but makes a written record to be inspected at the end of the flight. A second altitude instrument is the statoscope and rate-of-climb indicator. There are two instruments for showing two kinds of speed, air speed and ground speed, and one instrument for indicating how far and in what direction a ship is drifting. It is necessary at times to know whether a ship is on an even keel or whether banked or inclined. Two instruments employed for this purpose are the bank indicator and the inclinometer. For navigating, the

compass is extremely important. There are several types of this instrument. The latest development is the earth inductor compass, which instrument it was that added largely to the success of the recent trans-oceanic flights. Finally, of the many instruments to guide the pilot in operating his ship are those with reference to the power plant. These, roughly speaking, are divided into those instruments which show the revolutions of the engine per minute, the temperature of the engine and the pressure gauges for oil and air. Air pressure is necessary to force the gasoline through the carburetor in some makes of planes. Lastly, but an exceedingly important power-plant instrument, is that which shows the amount and the rapidity of the flow of gasoline.

Meteorological stations are absolutely necessary on an airway or the airway cannot be considered equipped with every safety factor. Through the great difficulties recently encountered in flying over the ocean much data of importance has been collected relative to obtaining and broadcasting atmospheric conditions. Fog, rain and high winds are the greatest detriment to flying. This makes it necessary that some organized system of weather reporting be available over every airway. The United States Weather Bureau co-operates in furnishing weather reports twice daily throughout the country. Aerial transportation, however, is so swift that it is necessary to have more accurate data of local fields at the time of flying. When a plane, therefore, is about to take off for a given destination, the pilot collects data from those fields over which he is to fly which gives him a fairly accurate picture of the condition, not only over the

field where he is to land, but over the entire airway. This service, known as the Meteorological Service, is a safety factor of prime importance.

Federal and State Legislation

As in the case of every other mode of transportation wherein public safety must be guarded, it became necessary to supervise flying by law. It is the opinion of good authority that between 80% and 90% of the fatalities in the past may be attributed directly to stunting. This may be a little high. It has been shown elsewhere in this paper that in 1925 thirty-four fatalities out of eighty-six were due to error in piloting. Of that same number of total fatalities, eighteen were due to faulty aircraft and twenty-five were due to stunting. This situation can be almost eliminated by the exercising of the law governing flying today. The Air Commerce Act became a law on May 20, 1926, after seven years of detailed study. In many of its phases it resembles the laws governing the Merchant Marine. The responsibility for its direction is invested in the office of Assistant Secretary of Commerce for Aeronautics, a newly created office under the Act. Of all the safety factors set forth in this paper the Air Commerce Act probably is the most important from the standpoint of life insurance underwriting.

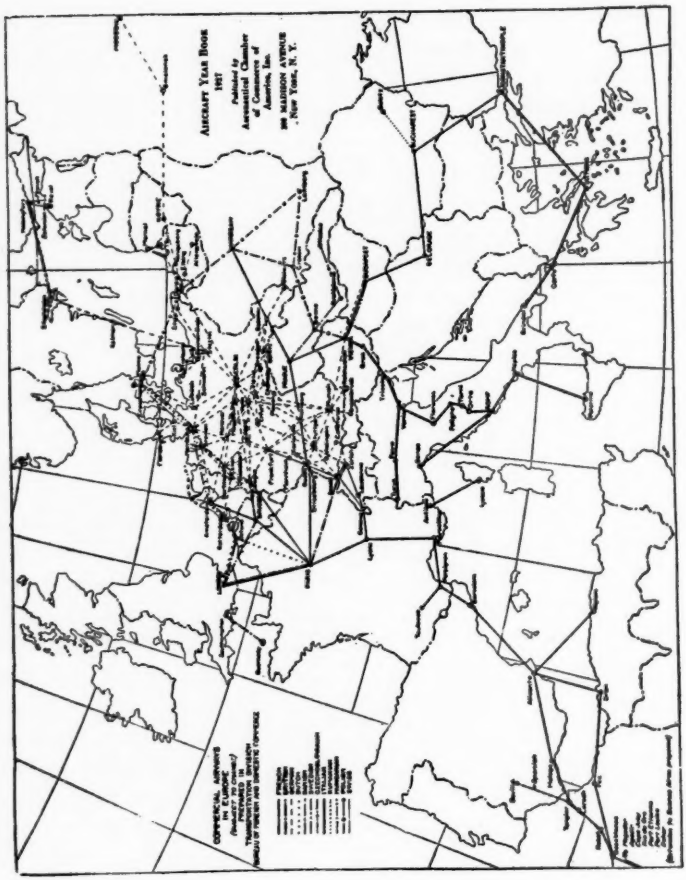
In addition to the Federal laws the several states are becoming cognizant of the fact that they must carefully supervise flying within their sovereign boundaries. In this respect they become a very important adjunct to the Federal law. The authors take pride in recommending a study of the laws governing flying

in the State of Connecticut. These have existed in that State with modifications from time to time for the past five years. The law is administered by the State Department of Aviation, at the head of which is a Commissioner, the first Commissioner of Aviation in the United States.

The life insurance companies would find it of distinct advantage to procure copies of Federal and State laws. A copy of the Federal law may be had by application to the Department of Commerce, Washington, D. C., and the State law of Connecticut may be obtained from the State Department of Aviation in that State.

Foreign Flying

A great network of air lines now covers Europe. The flying is chiefly of a commercial nature and passenger-carrying constitutes the largest percentage of it. It is not on the paying basis that the industry approaches in this country and most of the lines are operated through government subsidy. The equipment is good, however, and the air routes are not long. In most every case the pilots are carefully supervised. During the year 1926, there were thirty-three companies operating in Europe. The approximate number of miles of airway is, at this writing, somewhere between twenty and thirty thousand. Most of the flying is under government supervision, either military or civil. The most significant fact concerning foreign flying from the standpoint of life insurance underwriting is that policyholders will find it possible not only to travel by air in European countries but in every civilized country on the globe today.


AIRCRAFT YEAR BOOK
1931
Published by
Aeronautical Chamber
of Commerce of
America, Inc.
M. MADISON AVENUE
New York, N. Y.
COMMERCIAL AIRWAYS
IN EUROPE
(Regularly Operated)
PREPARED IN
THE AERONAUTICAL SECTION
BUREAU OF FOREIGN AND DOMESTIC COMMERCE

In order to secure the attitude of the life insurance companies today with reference to those who participate either as passengers or in other capacities in aeronautic activities, a questionnaire was sent to the fifty leading companies in the United States and Canada according to the volume of business in force January 1, 1927, and replies were received from all of the companies. This survey showed that nineteen companies are considering applicants in varying degrees, while thirty-one stated that they will not consider an applicant who either travels by air as a passenger or who is identified with the industry.

Results of Survey

The numbers designating the various companies which appear before the answers to the questions have no significance other than to identify their answers to the eight questions.

Question 1, "Do the policy contracts issued by your company contain a clause covering those who travel by air as passengers?"

Forty-two companies do not have a clause.

Eight companies have a one or two-year clause as follows:

3. If death occurs while participating in any aeronautic expendition or activity within two years of date of policy, either as passenger or otherwise, only the reserve will be payable.

4. "Aeronautics. If within two years from date hereof the Insured shall die as a result of engaging

in aeronautics other than as a casual passenger, the amount payable to the Beneficiary under this policy shall be the sum actually received by the company for premiums thereon and no more."

6. "During the first two years of this policy, the assured may not engage in any branch of aeronautics or make any aerial flights whatsoever, otherwise than as a passenger who is not owner of the conveyance, without the written consent of the Company and the payment of such extra premiums as the Company may determine. Should the death of the assured occur during the first two years of this policy directly or indirectly as a result of his so engaging in any branch of aeronautics or of making the aerial flights referred to above without paying the extra premiums required by the Company, the liability of the Company shall be limited to the return of all premiums paid."

7. Our policy contains a provision restricting the amount of liability to the reserve in the event of death from aeronautical activities within one year.

10. "Risks not Assumed: If within one year from the date hereof the insured shall participate in any aerial ascension.....and subsequently shall die as a result directly or indirectly thereof, the liability of the Company shall be limited to the amount of premiums paid in cash on this policy.

"Disability and Double Indemnity Benefits shall terminate in the event that the insured shall..... participate in aerial or submarine operations."

13. "This policy is unrestricted as to residence, travel or occupation, except that death while par-

ticipating in any submarine or aeronautic expedition or activity, either as a passenger or otherwise, or as a result of so participating, if within one year from the date hereof, shall render the Company liable for only the reserve under this policy."

16. "That death within two years from the date of any policy issued under this application, caused directly or indirectly by my engaging in any aeronautical ascension or activity, either as a passenger or otherwise, or occurring while so engaged (otherwise than in military or naval service in time of war, concerning which service conditions shall be made in said policy) is a risk not assumed by the Company and, in the event of such death, the liability of the Company shall be limited to an amount equal to the actual premiums paid on the policy."

34. "If within one year from the date hereof the Insured shall die either in consequence of engaging in an aerial flight or by his own hand, whether sane or insane, the liability of the Company shall be limited to the amount of the reserve hereon."

In answer to Question 2, "(a) Is there an extra premium charged to cover this protection? (b) What extra premium? (c) Is this premium a flat extra or does it depend on a sliding scale of the approximate number of times yearly the insured will fly?" the following statements appear:

2. We issue at standard rates to applicants of mature years whose finances show that they are willing and able to fly on nationally or internationally known air lines properly financed to conduct regular passenger service between two definite airdromes. Such

applicants we consider for limited amounts after very careful individual selection if a very limited number of flights is contemplated.

3. Each case considered on individual merits. Occasional flights with responsible pilot and reliable craft would not necessarily require a rating. As definite assurance as possible, however, required that flights not more than occasional and no intention of taking up flying as a regular pastime. It has been our attempt to consider all risks exposed to aviation hazard on such a basis, considering favorable applicants flying as much as three hundred hours a year acceptable with rating not less than $50.

6. (a) Yes, we assess the expected extra mortality by an extra premium. (b) $50 per $1,000 and up. (c) Our extra premiums are flat extras and if the number of flights intended to be made are few, we will agree to refund any extra overpaid, charging $2.50 per flight.

12. (a) Yes. (b) $25 per $1,000. (c) Flat extra.

14. Where the Insured states that he intends to engage in aviation or where we have other information to that effect, our issue will naturally depend upon our estimate of the probable amount of flying to be done by him. Reserve Officers and others who make occasional flights are accepted for a limit of $5,000 with an annual extra of $10 per $1,000.

19. Yes. $25 per $1,000—flat extra.

23. If the applicant reserves the right to make an occasional flight in connection with his business, our policy would be issued without any restriction being

imposed on this account. The treatment given in specific cases would depend on the special circumstances of the case. If the applicant stated he made weekly trips in connection with his business on recognized lines, we would charge an extra premium. We have not had any experience in such cases as yet. Extra charged would be a sliding scale.

25. If it appears that the applicant has recently made flights or is intending to make a flight or flights in the future, we decline, except that he would not object to, or require an extra premium for, an applicant who intends to take an air flight as a fare-paying passenger on a regularly established route as an incident to traveling.

26. We have accepted a few cases who have done a very limited amount of flying as passengers, who are first-class in every respect, and who fly only under the most favorable conditions, on life or endowment plans with an extra premium of $10 to $15 per $1,000 flat extra.

28. In the case where the applicant states his intention to take occasional flights as a passenger, we impose a lien of 90%, reducing 6% yearly, to cover death as a direct result of participation in aeronautics. Death must occur within three months of the accident to be considered a direct result of aviation. As a rule we use a lien but we would charge an extra premium if the applicant so desired. This extra premium is generally $35 per $1,000, but would vary to meet the merits of the individual case and might run as low as $10 per $1,000. The extra premium would depend upon the approximate number of times

yearly the assured would fly. We have had no cases of this kind but we feel that this is the way we would treat them.

32. If an applicant states that he intends to go to Europe and possibly fly from London to Paris, or some well-established route, all other things being satisfactory, we give him permission to make such a flight under our Regular Policies at regular rates.

33. Yes, except that we ignore approximately half a dozen admitted flights as passenger for pleasure. $10 to $25 per $1,000. Sliding scale—where question of future flights is doubtful we agree to refund the extra paid during any policy year if applicant at the end of the year makes an affidavit that he has not flown during such years.

35. Do not issue if passenger flights exceed one or two yearly and provided such flights are over established air lines. No extra premium if in accordance with above.

36. Yes. The Company's attitude in the handling of those engaged in aeronautics either as Professional Aviators, Non-Professional Aviators, or Passengers, will be as follows:

A. Professional Aviators—which will include Army and Navy officers, commercial flyers and air mail pilots —will not be accepted.

B. Non-Professional Aviators—such as men who were in the air service during the war, and others— (a) Those who fly a machine once a month or more frequently will not be accepted. (b) Those who fly less frequently than once a month will be accepted

for limited amounts with extra ratings, ratings running from $10 to $25 a year per $1,000, and without any form of disability insurance. Amounts will range from $2,000 to $5,000.

C. Passengers—we will include here officers and employees of aircraft concerns who ride in but do not operate machines—(a) Those who travel by air once a month, or more frequently, will not be accepted. (b) Those who travel by air less frequently than once a month will be judged upon their merits, with extra ratings graded from standard up to $25 per $1,000 and with amounts reduced, as the extra premiums increase, down to a minimum of $2,000.

38. Yes. From $5 to $25 per $1,000, depending upon the amount of flying anticipated. Flat extra.

41. No. If, when taking action on application, we have information that applicant makes several flights a year as a passenger we do not grant the insurance. If we have information that the applicant takes only an occasional flight—not more than one per annum—the insurance is issued at Standard rates.

44. Yes. While we prefer to use the aviation clause above described we will issue amounts up to $5,000 with an extra premium which depends upon the individual circumstances of the case. In the case of those who are flying regularly but not definitely following the profession of aviators, the extra premium ranges from $10 to $15 per $1,000 on the average, depending on the number of flights in a given period and the nature of the flying done. In the case of those who engage in commercial aviation on regular routes, under conditions which indicate that the planes

are subject to careful inspection, our extra premium is $25 per $1,000. This applies to persons who are definitely engaged as aviators professionally. The premiums referred to are flat extra premiums and are not fixed according to any sliding scale except that we may issue a policy with an extra premium limited to ten years in cases where it appears that the applicant will probably discontinue flying within that period. Our usual practice, however, is to make no limitation in time as our extra premium would be removed immediately the assured declared that he had given up aviation.

45. Yes. $50 per $1,000 per annum. Flat extra.

48. Two year non-renewable term. No extra. No death loss from aviation.

In answer to Question 3, "What restrictions as to amount and plan of insurance issued to an individual," the following statements appear:

2. We issue at standard rates to applicants of mature years whose finances show that they are willing and able to fly on nationally or internationally known air lines properly financed to conduct regular passenger service between two definite air dromes. Such applicants we consider for limited amounts after very careful individual selection if a very limited number of flights is contemplated.

3. Limits one-eighth to one-half of normal retention dependent upon rating and general circumstances attending the risk (normal retention $20,000). Not acceptable for Term Insurance. Extended insurance eliminated in most cases. Believe good practice to

issue certain types with slight present hazard but nebulous future on short non-renewable term plans standard or other form with right reserved to review risk at future date to determine whether we care to continue on risk or not.

6. Will insure on the regular plans, not Term, for about 10% of our limit.

12. Maximum limit, $5,000. Life and Endowment. No Term insurance.

14. Where the Insured states that he intends to engage in aviation or where we have other information to the same effect, our issue will naturally depend upon our estimate of the probable amount of flying to be done by him. Reserve Officers and others who make occasional flights are accepted for a limit of $5,000 with an extra premium of $10 per $1,000.

19. Restricted to general limit, $10,000; acceptable only on Life and Endowment plans; no Term, Modified Life, Joint Life, Salary Deduction or Wholesale granted.

23. We have not had sufficient experience with aviation risks to justify our formulating any rules or restrictions as to amount, plan, etc.

25. See answer to Question 2.

26. Have no set limit as to amount of insurance, this depending on each individual case.

28. There would be no restrictions in plan but we would restrict the amount of insurance issued to the individual.

32. Our limits as to amounts and plans are really

governed by the risk as a whole from a moral, physical and financial standpoint.

33. We issue any form, except Term. The amounts depend upon extent of activities—generally limited to $5,000 or $10,000.

34. No definite restrictions.

35. Do not issue if passenger flights exceed one or two a year and provided such flights are over established air lines.

36. Non-professional aviators—such as men who were in the air service during the war, and others—who fly less frequently than once a month will be accepted for limited amounts with extra ratings, ratings running from $10 to $25 a year per $1,000, and without any form of disability insurance. Amounts will range from $2,000 to $5,000. Passengers—include here officers and employees of aircraft concerns who ride in but do not operate machines—who travel by air less frequently than once a month will be judged upon their merits, with extra ratings graded from standard up to $25 per $1,000 and with amounts reduced, as the extra premiums increase, down to a minimum of $2,000.

38. Only on Life or Endowment policies, and the amount dependent upon the amount of aviation activities.

40. Term and Modified Life policies will not be issued.

44. With aviation clause no particular limit. With extra $5,000, plan Ordinary Life or higher premiums; not Term.

45. In the extra premium cases we generally limit the amount of insurance to $5,000.

46. Except for Term insurance, the company will not reject an applicant who occasionally makes aeroplane flights, although pilots and persons who made a business of flying frequently, will not be considered.

In answer to Question 4, "Is the insurance limited to any particular class of flying as, Commercial and Military?" the following statements appear:

2. We issue at standard rates to applicants of mature years whose finances show that they are willing and able to fly on nationally or internationally known air lines properly financed to conduct regular passenger service between two definite air dromes. Such applicants we consider for limited amounts after very careful individual selection if a very limited number of flights is contemplated.

3. Not necessarily; we have comparatively few of either because of the fact that our ratings have been considerably higher than those offered by several other companies prior to the present time. We have not attempted to meet competition on these risks.

6. We do not accept Civil Aviators making exhibition flights.

14. Professional Aviators, whether Officers of the Army, Mail Pilots or Civilian Pilots, are declined.

19. No. However, we decline to consider operators or pilots, testers, helpers, mechanicians on newly assembled planes; unlicensed pilots, stunt flyers, commercial advertisers, sky-writers, etc.; operators, owners, pilots, assistants on planes used at beaches, pub-

lic parks, county fairs or out-of-door exhibitions of any sort; all operators of motion picture planes. We class student and cadet aviators as unlicensed pilots.

25. If it appears that the applicant has recently made flights or is intending to make a flight or flights in the future, we decline, except that we would not object to, or require an extra premium for, an applicant who intends to take an air flight as a fare-paying passenger on a regularly established route as an incident to traveling.

26. We have accepted a few cases who have done a very limited amount of flying as passengers, who are first-class in every respect and who fly only under the most favorable conditions, on Life or Endowment plans, with an extra premium of $10 to $15 per $1,000, flat extra.

32. If the applicant discloses that he is connected with the Aviation Service in the National Guard, or the Army Reserve in the Aviation Corps, we do not grant him the insurance until he has resigned from the Service. We do not take aviators, pilots, or mechanicians actually engaging in flights.

33. We do not accept pilots who do stunt flying, nor do we accept Army or Navy pilots or observers. We do accept the midshipmen in the graduating class at Annapolis if they will state that they do not intend to volunteer for assignment to the Air Force. The same applies to cadets at West Point.

34. Limited to rare commercial flights. We occasionally insure an applicant who makes a strictly business flight on rare occasions. (This Company does not issue insurance to military or naval personnel.)

35. Do not issue if passenger flights exceed one or two a year and provided such flights are over established air lines.

36. Professional Aviators which will include Army and Navy Officers, commercial flyers and air mail pilots, will not be accepted. Non-Professional Aviators, such as men who were in the air service during the War, and others who fly a machine once a month or more frequently, will not be accepted. Passengers—include here officers and employees of aircraft concerns who ride in but do not operate machines—who travel by air once a month, or more frequently, will not be accepted.

40. Commissioned Officers in the Army, Navy, Marine Corps and Coast Guard who are now connected with the Air Corps or who expect to enter such service; first classmen of the U. S. Military and Naval Academies who upon their graduation expect to enter the Air Corps; Air Mail Pilots who are exclusively in the service of the Government and National Guard Air Corps Officers in states having federally recognized Air Corps units, will be considered on the basis of an extra annual premium of $25 per $1,000, payable in accordance with the manner of paying premiums. The amount of insurance will be limited to $10,000. The regular disability provisions will not be included, nor will the Accidental Death or Disability Income benefits be granted. Term and Modified Life policies will not be issued. If the applicant is connected with any of the several branches of the service mentioned above and question 5 of the application is answered in the negative, a signed statement must be submitted certifying that he has neither made application nor has any intention of making application for transfer to

the Air Corps. Those of lower grade than Commissioned Officers will be considered in accordance with the amount limitation and rating which apply to their rank, plus an extra premium of $25 per $1,000.

41. Insurance is not issued to aviators—either Commercial or Military.

44. Commercial only. Military risks with aviation clause where permissible.

46. Except for Term Insurance, the Company will not reject an applicant who occasionally makes aeroplane flights, although pilots and persons who make a business of flying or who fly frequently, will not be considered. No Annuity Waiver, no Waiver-Only Disability Clause, no Term granted; commercial report required in every case. Members of the Aviation Corps of the U. S. Military and Naval Reserves, who do not expect to make flights, whose term of service expires within two years and who do not intend to re-enlist, will be accepted. Commercial report necessary in every case. Term, Annuity Waiver, Waiver-Only Disability and Double Indemnity will be considered, if otherwise eligible. In all cases, submit informal application.

48. The cases that have been taken have been on the Two Year Non-Renewable Term with a rider eliminating death from aeronautical activities; hence, the class not limited on this plan.

In answer to Question 5, "Do you insure pilots, mechanics, testers, manufacturers of aircraft who fly and officials of air transportation companies? If so, does the extra premium vary with type of individual in-

sured? (a) What extra premium? (b) What limitations as to amount and plan of insurance? (c) Does extra premium vary with class of flying?" nine of the nineteen insuring those who fly answered this question "No."

3. We have made offers on all. Each case considered on individual merits. Occasional flights with responsible pilot and reliable craft would not necessarily require a rating. As definite assurance as possible, required, however, that flights not more than occasional and no intention of taking up flying as regular pastime. It has been our attempt to consider all risks exposed to aviation hazard on such a basis, considering favorable applicants flying as much as three hundred hours a year acceptable with rating not less than $50 per $1,000.

6. We accept applications on pilots with the exception of postal, civil and military aviators. We do not encourage applications from mechanics or testers. We will accept applications from manufacturers or officials of air transportation companies provided we can secure reliable information as to the number of flights they will likely take. The extra premiums required have been outlined above—we assess the expected extra mortality by an extra premium—$50 per $1,000 and up. Regular plans and amounts severely limited. Extra premium will depend upon class of flying.

12. When an extra premium is imposed it is the maximum $25 per $1,000 and upon the less hazardous classes $25 per $1,000 for all acceptable. Many classes not accepted at all. $5,000 any policy except Term. In answer to "c"—No.

19. Yes, except testers and others covered by our quotation under question No. 4 (testers, pilots, helpers, mechanicians on newly assembled planes, unlicensed pilots, stunt flyers, commercial advertisers, sky-writers, etc; operators, owners, pilots, assistants on planes used at beaches, public parks, county fairs or out-of-door exhibitions of any sort; all operators of motion picture planes). Extra premium $25 per $1,000. Restricted to general limit, $10,000; acceptable only on Life and Endowment plans; no Term, Modified Life, Joint Life, Salary Deduction or Wholesale granted.

22. We charge $25 per $1,000 extra to air mail pilots and Army and Navy aviators. We rate the other risks on the basis of $15 per $1,000 for each fifty hours of flying per annum. We issue on all plans except Term insurance. Extra premium varies with class of flying.

28. Yes, the extra premium would vary with the type of individual insured. Mail Service Pilots, and Forestry Patrol Pilots of Canada, would probably be considered the best of this class. For pilots in the Forestry Patrol Service, we would probably charge $35 per $1,000. The insurance would be limited to an Endowment plan, but, as a rule, we would prefer a lien to the extra premium. This lien generally runs for over a period of fifteen years. The extra premium would vary with the class of flying.

33. Yes. $10 to $25 per $1,000. Commercial Pilots and Air Mail Pilots are limited to $2,500 with $25 per $1,000 extra on any plan except Term. Premium does not vary with class of flying enumerated above as acceptable.

36. Passengers—include here officers and employees of aircraft concerns who ride in but do not operate machines—who travel by air once a month, or more frequently than once a month will be judged upon their merits, with extra ratings graded from standard up to $25 per $1,000, with amounts reduced as the extra premiums increase down to a minimum of $2,000.

44. Mechanics and testers who do not fly may be accepted with a relatively small extra of approximately $3, or possibly at standard rates, all depending on the individual circumstances of the case.

46. Except for Term Insurance, the Company will not reject an application of an applicant who occasionally makes aeroplane flights, although pilots and persons who make a business of flying or who fly frequently will not be considered.

Question 6, "Has your aviation clause any limitation as to where and how the insured must fly?":

32. If an applicant states that he intends to go to Europe and possibly fly from London to Paris, or some well-established route, all other things being satisfactory, we give him permission to make such a flight under our Regular Policies at regular rates. We feel that the hazard from flying infrequently, purely as a passenger and more for the sake of the experience than anything else, is a small one, for after their curiosity has been satisfied, they will not make any more flights. It may be interesting for you to know that while some of our old contracts do not give permission to make aerial flights, we would recognize a claim if death occurred by reason of making a flight. Under our present applications, we ask if the

applicant intends to make any flights. If he should answer in the negative, and then six months later should write that he was contemplating a flight from Boston to New York, or Paris to London, we would write that such a flight would not invalidate his contract.

In answer to Question 7, "Do you issue disability benefits or double indemnity under these contracts?" thirteen of the companies insuring those who fly answered "No."

2. Disability is considered on applicants of mature years whose finances show that they are willing and able to fly on nationally or internationally known air lines properly financed to conduct regular passenger service between two definite air dromes. Our Double Indemnity clause contains the usual exception if death results from accidental means occasioned by an aircraft ascension.

25. We do not issue policies at all if the applicant is likely to fly other than as a fare-paying passenger on a regularly established route. No policies either with or without Disability benefits or Double Indemnity are issued under conditions described in No. 5 (pilots, mechanics, testers, manufacturers of aircraft who fly and officials of air transportation companies). The Double Indemnity (accidental death benefit) is not payable if death shall have resulted from bodily injuries sustained while participating in aviation or aeronautics except as a fare-paying passenger.

28. Yes, with restrictions, in their clauses.

33. No—not to pilots. We do, however, to those

who fly as passengers because our Disability and Double Indemnity clauses are restricted—Disability Benefit shall not apply if the disability of the insured shall result from engaging as a passenger or otherwise in Aviation or Aeronautics, and Double Indemnity shall not be payable if insured's death shall result from participating as a passenger or otherwise in Aviation or Aeronautics.

41. Disability benefits granted.

48. No indemnity will be paid for any period of disability caused directly or indirectly while in or on, or operating or handling any vehicle or mechanical device for aerial navigation, or in falling therefrom or therewith.

In answer to Question 8, "Are you contemplating the extension of coverage to those who travel by air at this time," forty-three companies replied that they were not contemplating any change.

2. Not immediately. We are constantly studying the situation.

3. Yes, provided we can place ratings consistent to the hazard believed to exist. The "boom" in aviation following Lindbergh's feat has demonstrated that flying is almost certain to become a more common means of transportation and insurance in general must keep pace. Favorable legislation regarding riders and aviation restrictions would be of considerable assistance in the handling of cases where the extra hazard is not severe but enough to prevent "care-free" underwriting. Careful study and sane underwriting should permit the judicious acceptance of the others at proper rates.

32. Summing it up in a general way, we do not believe the time has come when we can definitely quote a rate for the regular aviators either in the Army or Navy, Commercial or Airplane Service, but we do not consider the risk great among our policyholders making one or more infrequent trips.

34. The subject is receiving special attention at this time.

36. When the next reprint of our Life policy is made it is the intention to introduce the subject of aviation in some form that will give protection to the Company.

41. Not at present but will probably become more liberal as statistics warrant.

48. Yes.

Summary

In conclusioin, it is very evident that aviation in this country has made rapid progress during the past year with particular reference to the safety factors involved in this growing industry. We have pointed out in our paper that on the volume of business two years old, the fifty leading life insurance companies in the United States and Canada are covering travel by air, if our policyholders want to so travel, to the extent of $73,276,680,279 without any restriction, and in addition, it has been pointed out that the accident companies during the past six months have liberalized their policy contracts to cover any loss caused by any hazard of aviation while the insured is riding as a passenger in a licensed airplane operated by a licensed

pilot upon a regular passenger route between definitely established airports.

As a result of our investigation of the industry itself, it is safe to conclude that travel by air as a passenger in a licensed airplane operated by a licensed pilot upon a regular passenger route between definitely established airports is reasonably safe. The policy contracts of the companies studied do not place any restrictions on travel by automobile, railway or steamship. As we do not have travel by automobile, railway or steamship eliminated in our policy contracts in the one or two-year rider, a rider eliminating liability as a result of air travel does not appear to be a necessary provision as to passengers riding in licensed airplanes operated by licensed pilots upon regular passenger routes between definitely established airports.

It is our further opinion that, in view of the development of this means of travel, together with the action of a number of life insurance companies who are now taking applicants who travel as passengers in licensed airplanes operated by licensed pilots on regular passenger routes between definite airports, and who fly from one to six times a year under these conditions, we have now arrived at the stage of considering such applicants in normal cases for Standard insurance without limitation.

In our survey of the action of various companies we have shown that there is a wide variation of action. One company, it will be noted, accepts commissioned officers in the Army, Navy, Marine Corps and Coast Guard who are now connected with the Air Corps, or who expect to enter such service, with an extra premium of $25 per $1,000. In this class of service, as

pilots, we have shown that it is a part of their duty and training to engage in aerial acrobatics. This same company will not consider an applicant who flies as a passenger.

Another interesting fact that our survey shows is that the extra premiums charged in the various branches of the industry are largely dependent upon the number of flights taken or hours flown. Even though the number of exposures may influence the underwriting of those who fly, it is our opinion that the important factors are where and how the insured is to fly.

With regard to the insuring of pilots, it is apparent that those who fly for commercial companies over regularly prescribed routes and carrying passengers, freight and mail, are the safest type. We realize, on the other hand, that the spread could not be at all large for this class at the present time. It is further realized that this type of risk may at any time discontinue commercial flying to enter the experimental or military fields, which adds a definitely undesirable feature to the underwriting.

Finally, there are the executives and employees other than the pilots of a company engaged in aeronautics. It would seem very unwise to insure them without determining exactly their duties, and understanding the hazards attached thereto. They should be classed according to the hazards just as is done when insuring any other occupation.

The authors are deeply indebted for the co-operation given by the following organizations and individuals. Without their co-operation, this paper would not have been possible:

The United States Department of Commerce
Aeronautics Branch

Chamber of Commerce of the United States of America
Washington, D. C.

Aeronautical Chamber of Commerce of America, Inc.
300 Madison Avenue
New York, N. Y.

United States Post Office Department
Aircraft Year Book

"U. S. Air Services"
September, 1927

"Aviation"

"Aero Digest"

National Advisory Committee for Aeronautics
Report No. 125
Aeronautic Instruments, Section I

National Air Transport, Inc.
Chicago, Illinois

Pacific Air Transport
San Francisco, California

Ludington Exhibition Company, Inc.
Philadelphia, Pa.

Curtiss Flying Service, Inc.
Garden City, L. I., N. Y.

New England Aircraft Company, Inc.
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Stout Metal Airplane Company
Dearborn, Michigan

Ryan Airlines, Inc.
San Diego, Calif.

Travel Air Manufacturing Company
Wichita, Kansas

Atlantic Aircraft Corporation
110 East 42nd Street
New York, N. Y.

Alexander Aircraft Company
Denver, Colorado

Loening Aeronautical Engineering Corporation
31st Street and East River
New York, N. Y.

Robertson Aircraft Corporation
St. Louis, Mo.

Keystone Aircraft Corporation
Bristol, Pa.

Fairchild Aerial Surveys
270 West 38th Street
New York, N. Y.

The Skywriting Corporation of America
50 East 42nd Street
New York, N. Y.

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New York, N. Y.

Colonial Air Transport
270 Madison Ave.
New York, N. Y.

Dr. Beckett—We will now hear from Dr. Bartlett.

Dr. Bartlett—Dr. Sykes and Dr. Smith have clearly stated the many difficulties that confront us when we try to insure those who expect to travel by air and their paper is so complete that it is hard to know what to take up in discussion.

Some of these difficulties are of a nature frequently met with in insuring applicants in other occupations while other difficulties are peculiar to this industry. Let us consider these difficulties more in detail. Most companies ask specifically whether an applicant has flown or expects to fly. The question on our application reads as follows: "Have you been, are you now or do you contemplate engaging directly or indirectly in any form of aviation?" If this question is answered in the affirmative we require that a special questionnaire be used. This contains twenty-three questions and is designed to bring out all the facts in

relation to an applicant's connection with aviation either as passenger, pilot or otherwise. It should be supplemented by careful inspection both through Agency channels and independent sources.

Having determined that an applicant intends to fly either as passenger or otherwise, we must properly classify him in order to estimate the extra hazard involved. Dr. Sykes and Dr. Smith show us that the hazard is directly dependent on certain factors of safety. These include the following:

1. The ability and training of the pilot.

2. The efficiency of the equipment and of the ground the plane starts; the country over which it travels and organization which oversees the preparation of the plane.

3. The airway, which includes the field from which more especially the landing field and the possibilities for forced landings, should such be required.

More than all else the hazard of flying is directly dependent upon the frequency with which flights are made.

"For the more frequently the pitcher goes to the well, the sooner is it broken."

Taking all these hazards into consideration we may classify our risks into two main divisions. First, passengers, and second, those engaged in the airplane industry, either as pilots or ground workers. Pilots may be divided into those engaged in military service in the Army and Navy; those engaged in commercial aviation, including the air mail, and third, the stunt flyers, gypsy flyers and flyers engaged in giving exhi-

bitions, sky-writing or in the moving picture industry. Of the three, commercial pilots are the safest and recent statistics show that their factor of safety is constantly improving. Figures furnished by the Air Mail Service show that in 1919 there was one fatality for every 65,000 miles of flying, while in 1925 and 1926 over one million miles were flown for every fatality. Flying in the Navy, as judged by air distance, is about five times more fatal than flying in the Air Mail. The average death rate as the result of aeronautic hazards among United States Navy Officers for the period 1921-1925 was 36.9 per thousand, which is about ten times the fatality rate prevailing among anthracite coal miners. Anthracite coal mining is the most hazardous industry accepted by most companies.

After we have classified our applicant we are confronted with the fact that his status may quickly change. The ground man of today may be a pilot tomorrow and the pilot may become a stunt flyer. This fact was well illustrated this summer when to fly across the ocean appeard to be the ambition of many aviators of both sexes. Moreover the applicant who states that he expects to take only an occasional flight on business may go much further than his original intentions promised. As an example of this let me mention three instances. An applicant connected with a well-known motor industry stated that he did not expect to fly except for an occasional short trip between Detroit and Chicago. Within a week after receiving a policy he flew to San Francisco and back. Another applicant was interested in air transportation as a side line to his regular occupation and stated that he might take an occasional short flight. Shortly after receiving a policy he

started around the world and only stopped at Japan when our Government requested him to do so. A day or two ago we saw in the paper that Will Rogers had successfully completed a flight from New York to Los Angeles. Mr. Rogers is well known to us all because of his stage and literary career and to some of us as a recent applicant for life insurance.

When we consider the many difficulties that beset this problem we should be glad that we are Medical Directors and not Actuaries; for it seems almost impossible to fix a rate adequate to protect a company against a risk so variable. Theoretically the rate should be based on the number of air miles flown per year with due consideration given to the efficiency of the organization and the nature of the ground over which the flight is to be made. Passengers travelling occasionally on regular airways in Europe are reasonably safe and may be accepted without a rating, but the industry is not yet sufficiently developed in this country to enable us to make a favorable comparison. Licensed pilots traveling regular routes should receive the most favorable rating; Army and Navy flyers are less favorable, while testers, instructors and exhibition flyers are uninsurable at any practical rate. The chief underwriting problem involved is to determine the actual intention of the applicant in order to exclude those who seek insurance to protect against an unusual immediate hazard.

In view of the insistent demand to insure aviators my Company decided last March to consider applications on the lives of some of the more favorable individuals in the airplane industry. An extra premium charge was made of $10.00 to $12.50 per thousand. It was soon found that this premium was inadequate

and that our classifications were too broad. From March to July we issued 181 policies amounting to nearly one million dollars of insurance. On July 15th conditions were radically modified and we now charge an extra premium of $25.00 per thousand. We allow no commission upon the extra premium and prohibit advanced collection of the premium. Our general limit is $10,000, which must be on the Life or Endowment plan. Our agents are requested not to solicit this class of business. Since the new rate went into effect we have written only two policies.

We decline consideration of operators or pilots, testers, helpers, mechanicians on newly assembled planes, unlicensd pilots, stunt flyers, commercial advertisers, sky writers, etc., operators, owners, pilots, assistants on planes used at beaches, public parks, county fairs or out of door exhibitions of any sort, all operators of motion picture planes.

We have written 183 policies since March 1, 1927, and have had two death claims, each for $10,000. In each case death occurred by accident a few days after the application was written.

Dr. Beckett—Dr. J. M. Smith, of The American Central Life Insurance Company.

Dr. Smith—I fully realize the task imposed upon me in attempting to discuss the most excellent paper prepared by Drs. Sykes and Smith. I recognize my incompetency and know of no reason for my participation in this discussion, unless Dr. Beckett, knowing of my failing of "going up in the air" when called upon to speak in public, considered this a qualification.

The gentlemen have given us a very complete and

comprehensive exposition of the various phases of aviation. They have traced the development of the airplane, furnishing historical data which should be especially useful to life insurance underwriters. Their studies of the question of aeronautics have been exhaustive, and, I am sure, everyone agrees that they have made a very valuable contribution to our Association.

How to properly underwrite the hazard of flying is a real problem which life insurance companies are forced to face. More people fly each year. The public is coming to regard flying as reasonably safe under normal conditions. Life insurance companies must acknowledge the challenge and provide protection for this class. This is not only an economic obligation, but a moral one as well, whereby life insurance companies may encourage the advancement of this great industry. It, therefore, behooves us to look upon the subject with open minds and with a willingness to learn. It is to be regretted that the doctors have not given us a guide or yard stick with which to measure these risks.

The problem of insuring the lives of those who are subjected to the aviation hazard is being studied constantly by the Company I represent. Early in the summer I addressed a questionnaire, similar to that employed by Dr. Sykes, to the Medical Directors of a number of life insurance companies in the United States and Canada. It was our desire to ascertain what other companies were doing. We received replies from 203 companies, both large and small. This survey covers four times as many companies as Dr. Sykes'. For that reason, the results are given:

Occasional flyer:

10 companies accept at standard rates without reservation.
25 companies accept at standard rates with reservation.
6 companies charge extra rates ranging from $10.00 to $25.00 per M.
1 company imposes a rating of $1.00 per M for each flying hour.
161 companies do not accept.

Commercial flyer:

24 companies accept with ratings ranging from $20.00 to $50.00 per M.
6 companies reinsure all flyers of this class.
2 companies accept standard with reservation.
170 companies do not accept.

Air Mail Pilots:

22 companies rate from $10.00 to $25.00 per M.
6 companies reinsure all.
2 companies accept standard with reservation.
172 companies do not accept.

National Guard and Army Reserve Aviators:

23 companies rate from $10.00 to $50.00 per M.
6 companies reinsure all.
1 company accepts standard without reservation.
4 companies accept standard with reservation.
168 companies will not consider.

Fifty companies differentiate between passengers and pilots, twenty-three do not.

Forty-five companies, only, have incorporated in their application blank a question with reference to flying.

One is forced to marvel at the great progress that has been made in this industry when one realizes that it was only twenty-four years ago that Orville Wright made his first attempt at flying, and then was able to stay in the air only a few seconds. Since the war, the development has gone ahead by leaps and bounds. Before that time, I doubt if any insurance company underwrote a person subjected to the flying hazard.

Nine years have made a great change; many companies are now giving these risks careful thought and consideration. It is of interest to note that in Germany, the Deutsche Lufthansa and its affiliated companies have arrangements with the Stuttgarter Versich-erunge-Verein (Stuttgarter Insurance Corporation), whereby automatic insurance is purchased by each passenger when he buys a ticket. The coverage includes 25,000 reichmarks (about $5,950) in case of death or permanent disability. In case of temporary disability, resulting from accident, the passenger receives 25 reichmarks for each day he is prevented from following his profession. The Lufthansa states that the insurance company is doing a very satisfactory business under this plan, owing to the small number of accidents that occur.

The Belgian company, "Sabena," operating with its reserve, creates funds for the insurance of its pilots, and the members of the working staff are insured against the risk of labor accidents by virtue of obligatory legal insurance. Passengers are insured only at their special request by paying a premium. The aviation company has a floating policy with the insurance company, premiums being paid by the passenger when application is made.

These facts interest us only in a general way be-

cause conditions in Europe are different from those in the United States. We are not especially interested in accident or life insurance for short periods of time.

The essayists have devoted several paragraphs to Aviation Medicine. This information has been exceedingly interesting. Fatigue is a condition to which aviators are subject, and for which flight surgeons are constantly on the lookout. The symptoms of flyers' fatigue are those of a neurocirculatory asthenia, the result of too constant application to flying, lack of exercise, dissipation, or flying in high altitudes. Flying induces fatigue, and fatigue which becomes chronic is called "staleness." When suffering from this condition, the flyer is likely to exercise poor judgment which is very frequently the cause of accidents. Experience of the Army Air Service Medical Research Laboratory has shown that one of the earliest symptoms of "staleness" is the flyer's inability to judge distances properly, and, therefore, he makes poor landings. Military flyers are especially subject to "staleness."

Dr. Sykes concludes that *where* and *how* the insured is to fly are the important factors to consider in arriving at proper rate to charge those engaged in this industry. We agree that *where* and *how* the insured is to fly are extremely important factors, but we wonder if they are the most important. Mortality is not confined to the inexpert pilots or the antiquated craft, although, of course, they have a bearing. Forced landings are bound to occur where there are no landing fields. If a single flight offers any danger at all, we believe that the more flights made the greater the danger will be, also the longer the period of time in the air, the greater the hazard. It would seem, therefore, that the rate charged should be in proportion to

the number of flights and the length of time of exposure.

The Aircraft Year Book for 1927 makes the statement that statistics show that lack of weather data, engine trouble, and errors in piloting, in the order named, were the causes of a large majority of accidents. It is believed, however, that the control and airways work of the Aeronautics Branch of the Chamber of Commerce will serve to minimize the first and last of these causes. With greater improvements being made constantly on aeroplane engines, it is thought the second cause will be much lessened.

Not so many years ago, the public was constantly being horrified by newspaper accounts of mangling railroad accidents met with by trainmen. In those days, in coupling freight cars, it was necessary for the brakeman to stand between the cars, hold the coupling link in one hand and drop the coupling pin with the other. When freight trains came to a stop, it was necessary for the brakeman to run over the tops of the cars to apply the brakes by hand. If those men were accepted for life insurance at all, they were rated very heavily. Today, all has changed by the advent of the various safety devices employed by railroad companies, and trainmen are accepted at standard rates or with very slight additional premiums. These safety measures all had to be proven and demonstrated before life insurance companies were willing to let down the bars. Therefore, it is reasonable to suppose that a similar evolution will take place in the field of aviation.

A meeting is scheduled for December 5th by the National Aeronautics Conference which should play an important part in securing for aviation that element

of safety which is so necessary for the future success of aerial transportation.

It is true that great progress has been made in overcoming these hazards. Statistics of the Government Mail Service disclose a flattering record of mileage compared with accidents involving the loss of life and planes. However, looking at it from a different angle, the record does not sound so well. In the last nine years, since the first air mail route was established, it is reported that about forty pilots have been killed, though not more than that number have been employed at any one time.

All sorts of safety devices are being introduced, but we believe that time only will demonstrate their efficacy in making aviation more safe. Until that time comes, life insurance companies should continue to class this occupation as extremely hazardous.

Dr. Beckett—This paper is now before you gentlemen for discussion. Is there anyone that would like to speak on this paper?

Dr. McCulloch: One swallow doesn't make a summer, and yet I think I should like to lay before the gentlemen here some information which might influence them in subsequent consideration.

I had some experience in flying during the war, when we used to start out with an ambulance on one side and a grave-digging detail on the other. A couple of weeks ago, I flew from Brussels to London, bearing in mind always the comfortable thought that I had a very sizeable policy in your President's company. When I got on board the ship, the photographs of which have just been displayed here, when I saw the sturdy motors, one on each side and saw the wide-spreading wings, when I realized that one

could walk up and down the middle pathway, upright, without losing his balance or tipping the ship, when I saw the elaborate toilet facilities in the rear, I felt that same degree of affection for the good air ship that one acquires for a stout transatlantic liner or for a faithful Henry Ford, and I was only a little sorry, sentimentally sorry, in my own mind that they had designated this noble ship by a mere number instead of something more appealing and poetic like "The Albatross" or "The Eagle of the Air" or something of that kind.

And then when we skimmed across the fields of Flanders and the separating channel and landed safely at Croydon Air Field, with all the necessary safeguards perfectly apparent before us, I felt there was nothing to this whole problem as far as passengers are concerned, and under the restrictions outlined—nothing to it more than an ordinary hazard. But, alack and alas! my fellow townsman, who flew the same day from Paris to London told me that they landed his plane just on the far edge of the channel. They had landed, or so at least the pilot said, to telegraph to London to see if the fog would permit them to land there. He saw them, however, pouring gallon after gallon of gas into the tanks. A couple of days later, someone in authority told him they had landed because their last drop of gasoline was gone!

Under those circumstances, gentlemen, I have altered my opinion as far as aeroplane risks are concerned. For a year or two yet, like my Scotch friend, "I hae me doots."

Dr. Beckett—Has anyone else any remarks to make? If not, I will ask Dr. Sykes to close the discussion on this paper.

Dr. Sykes—I will ask Dr. Smith to close the discussion. I might say that Dr. Smith is the Commanding Officer of the 43rd Division Medical Detachment, a graduate of Mitchell Field Flying School, Chairman of the Aeronautical Committee of the Hartford Chamber of Commerce, Federal and State examiner, and he thinks nothing of flying. I have never been up but he has been up many times.

Dr. Smith—That was a quite flowery sendoff. Dr. J. M. Smith said that unfortunately we have not given a measure whereby these risks might be measured. We realize that the paper falls short in that respect, but we could not give a scale whereby we could tell how to insure these risks. We do not know of any such measure.

I only want to say in explanation that if this paper gives you some ideas on aviation, we will feel that it has served its purpose. I would like to point out that I do not feel that we can go very far but we can, I believe, go further than we have in insuring the passengers, and that is where we practically stop when we speak of standard rates.

The question as taken up in Dr. J. M. Smith's paper, of where, how and how often is exceedingly interesting. Dr. Sykes and I will agree, of course, that the more exposures, the more chance for accident. This is the same regarding railroads, steamships, and, last but not least, automobiles, but it is the individual who is going to meet these situations, and it is the safeguards that surround the passenger that are exceedingly important. That is what we tried to bring out in our paper.

It seems from studying this question from the life insurance company's standpoint that the general consensus of opinion is how many times or how many

hours is the individual going to fly. I see it just a little differently, and that is as expressed in the paper —how and where he is going to fly. If you will stop to think, railway engineers and operators of every kind of common carrier are not, as I understand it, taken at standard rates, and that brings up the question of the pilot, who is certainly not insurable at standard rates. Army and Navy pilots particularly are not so insurable because, even though they are carefully watched and carefully selected and fly with excellent equipment, the life, nevertheless, is rather a hazardous one.

I just want to point out the record of the air mail for 1927 which is very remarkable. There was, I think, over a million and a half miles flown per fatality and remember, Gentlemen, a good bit of that was flown at night. The advancement in night flying has been remarkable and is a positive indication that, from the safety standpoint, we are in an entirely new era in flying.

I was exceedingly interested to hear Dr. McCullouch's talk about his trip and how he felt after he got into the ship and flew—how safe he felt. We all feel that way when we fly and I am sure that I could do no more than advise each and every one of the members here who has a chance to take a flight with a good pilot and good equipment to avail himself of the opportunity, because it will give you an entirely different idea of what this thing is all about.

Dr. Beckett—I see that we have a little time left us before luncheon and if Dr. Johann is present, I will ask him if he has any preliminary remarks to make; if so, I will ask him to come forward and we will listen to them at the present time.

Dr. Johann—I have nothing to offer at this time.

APICAL CARDIAC MURMURS

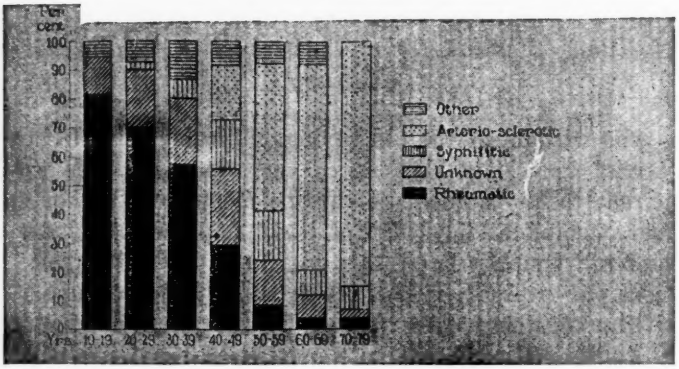
By A. E. Johann, M. D.

Assistant Medical Director, Bankers Life Insurance Company

The wisdom of the old saying, "Truth is simple but partial knowledge difficult of comprehension," is apparent to any student of cardiac murmurs. Although more complete knowledge of heart impairments doubtless will simplify the future problems of medical selection, our present limitations make satisfactory underwriting of these cases difficult if not unattainable.

A discussion of all the varieties of heart murmurs heard at the apex would be both impractical and impossible, consequently, apical murmurs associated with or frequently attributed to organic mitral valvular disease will be the only types considered.

Fundamental to an intelligent consideration of mitral valvulitis is the necessity of determining if possible the major etiological factors. Some recently published data bearing on the subject, obtained through sources more accurate than the histories given insurance examiners, furnish information of considerable practical value. The studies of Wyckoff and Lingg (1) indicate that organic heart disease developing before age forty is in most instances the sequel of rheumatic infection. Their observations regarding this point are shown best by the accompanying figure copied from their paper.


Per cent.
100
90
80
70
60
50
40
30
20
10
0
Yrs.
10-19
20-29
30-39
40-49
50-59
60-69
70-79
Other
Arterio-sclerotic
Syphilitic
Unknown
Rheumatic

Cohn (2), in his comprehensive article, is author of the statement that all cases of valvular heart disease under age forty may be considered for all practical purposes to be rheumatic in origin. Beyond age forty the predominant causes of organic heart disease are recognized as syphilitic or arteriosclerotic in character. It is to the group under age forty, giving so frequently a negative personal history and usually reported normal on physical examination except for an apical systolic murmur, that the writer would direct attention especially.

For reasons obvious to anyone who has had experience in medical underwriting, it is impractical for the purposes of medical selection even to attempt classifying cardiac impairments solely on the basis of history. Numerous observations indicate that in cardiac disease recognized definitely of rheumatic etiology there may be no evidence of focal infection or other rheumatic involvement and no history of that nature. Sir Thomas Horder (3) is of the opinion that "Rheumatic fever in the severe form which was so common twenty-five years ago is not at all a common disease today * * * but there has probably occurred an increased frequency of the subacute and chronic forms of infection together with subacute and chronic endocarditis." In addition to those who are unaware of their history of rheumatic trouble there is the group we have all encountered who deliberately conceal their unfavorable history or minimize its seriousness.

Equally impractical is it from an insurance standpoint to require repeated examinations or prolonged observation before arriving at a diagnosis. Employment of various ultrarefinements of examination, possible of application only in larger cities, doubtless is

advisable in certain cases but to be of much value we must have methods of examination the average physician can apply. A quotation taken from a personal letter written by a leading internist indicates how far in his opinion we are from this ideal. He states: "The decision as to whether a murmur is organic or functional, I believe, can never be determined by any single point. The past history is important and from this point of view insurance companies have difficulties. The question of hypertrophy is important and of course can be misappraised. In many instances it is a big job to decide and generally beyond the scope of the insurance physician."

Apparently there is ample basis for skepticism of the ability not only of average but of excellent examiners to map out accurately the heart boundaries by percussion. With the development of teleradiography it has been demonstrated that moderate variations from the normal cardiac outline cannot be demonstrated consistently by percussion; that moderate degrees of hypertrophy are often overlooked and that hearts normal in size but in somewhat abnormal positions are frequently considered to be hypertrophied. Neuhoff (4) states, "It is extremely difficult to delineate by percussion even the approximate size of the cardiac area. In other words, the physical evidence of cardiac enlargement must be definite and unmistakable before its diagnosis is ventured." Similar views have been expressed by Green (5) and Vaquez (6).

In spite of the present tendency of clinicians to minimize the importance to be attached to murmurs in reaching the diagnoses of heart impairments, the probability of employing anything of greater practical diagnostic value in insurance selection appears remote. The

examining physician frequently denied the opportunity of obtaining an accurate or complete history and compelled to base his opinions upon only one or two examinations is forced to depend chiefly upon auscultation. Unquestionably the information furnished most frequently by the examiner regarding the heart, and probably the most accurate as well, is that obtained with the aid of the stethoscope. Common sense, therefore, would dictate our relying upon auscultation as the most accurate practical means available of differentiating between the various cardiac conditions presented by applicants for insurance.

Although a few companies insure the more favorable cases of recognized mitral stenosis at the highest substandard rates it is, as we all know, the practice of the majority of companies to reject risks of this type. Bearing on this point the following quotation from a recent article by Cohn (2) is interesting:

"Coombs states it is a fact that sixty-six per cent of cases of heart disease following on rheumatic fever occur between the ages of five and fifteen. Thayer gives the same percentage below twenty. Mackie's cases below twenty were fifty-five per cent. * * * It may take then one to six years for the cardiac lesion to form. Meanwhile manifestations of rheumatic disease may be quite absent. Next the length of time before heart failure begins Romberg gives as approximately seven years in 102 cases of valvular heart disease in his Leipzig Clinic. The stage of heart failure itself may on the average last, as he shows also in a study of 172 cases in Leipzig Clinic, four and eight-tenths years. If now these periods are summed up—(1) the period from the beginning of infection to the establishment of the chronic valvular lesion, say one to eight years, the average about four years; then (2) from this point to the onset of heart failure, say about

seven years; and finally (3) from this point to death, say about four years, the total period is somewhere in the neighborhood of fifteen years. On the assumption that Church's figures and those of Ingerman and Wilson and Miller and Poynton are correct and that the ages five to fifteen embrace the usual period for infection from rheumatic fever the disease will have run its course by the ages of twenty to thirty years. Or if the higher figures in Church's table are to be considered, namely, those which assign twenty-five per cent of cases of rheumatic fever to the third decade, the twenty to thirty years age group, the disease will have run its course between ages thirty-five and forty-five."

Admittedly the number of cases upon which this author has based his statements is small, but since the general trend of clinical observation supports Cohn's conclusions the opinion of medical directors regarding the undesirability of cases of mitral stenosis appears fully warranted.

Within recent years much has been written by clinicians regarding the rarity of uncomplicated mitral insufficiency. Probably Dr. Cabot's (7) book, "Facts on the Heart" has done more than any other publication to reawaken the interest of medical directors in this commonest of cardiac impairments reported by insurance examiners. Other authorities although not so radical in their views, in the main confirm Cabot's observations. Sprague and White (8) in discussing mitral disease of rheumatic origin make this statement: "It should be evident that this diagnosis is an important one to make, chiefly for the reason that mitral regurgitation, in the great majority of cases, leads to mitral stenosis, and the early recognition of mitral endocarditis may stimulate efforts to limit the recurrences of rheumatic infection to which such patients are un-

fortunately so liable. Much less frequently the lesion remains stationary, and we find what we have called 'pure mitral regurgitation' lasting beyond middle life." In another place in the same article we find, "Pure organic mitral regurgitation is a clinical entity but is not demonstrated at necropsy as it is rarely if ever fatal. This does not, however, decrease its significance, since regurgitation is usually but one stage in the process of stenosis which is more often the terminal condition. Under the most favorable conditions organic mitral regurgitation exists as a potential danger."

Accumulating evidence justifies the prediction that in the future whenever organic mitral regurgitation is diagnosed the presence of mitral stenosis will be assumed until proof to the contrary is furnished.

The proceedings of this association contain several admirable papers (9) indicating that large groups of so-called uncomplicated cases of organic mitral regurgitation may be insured profitably at a 200% rating. If the views regarding the coexistence of stenosis with organic mitral regurgitation and the undesirability of mitral stenosis types are correct, questions justifiable may be raised regarding the composition of the insured group of supposedly uncomplicated mitral regurgitation cases. Is it not probable that the group was made up almost entirely of two subgroups, one of which comprised the cases of organic mitral disease insufficiency with stenosis frank or incipient; the other group composed of cases showing functional apical murmurs not due to organic cardiac disease?

Dublin (10) has estimated that there are two million cases of heart disease in the United States and has presented figures which indicate that except for hypertrophy, mitral valve abnormalities are the most com-

mon structural lesions. It is apparent, therefore, that the problems of medical selection presented by cases of mitral valvulitis are not of mere academic interest but on the contrary demand the most serious consideration of every medical underwriter.

Few physicians have had an opportunity to follow the course of cases of mitral endocarditis from inception until death unless the progress of the disease has been unusually rapid. It is not surprising, therefore, that different stages of this condition should have been considered separate clinical entities rather than various manifestations of a single disease essentially chronic, slowly progressive, but eventually causing the death of the patient. Nor is it surprising that in insurance selection the generally accepted views of clinicians were followed.

The relative ease with which apical systolic murmurs are heard probably is the chief reason for the frequency of the diagnosis "uncomplicated mitral regurgitation." One of two factors may explain the examiner's failure to recognize a complicating stenosis: The valvulitis may not have progressed sufficiently to have produced recognizable signs or the technic of examination may have been such that latent signs were not made prominent or faint signs if present were overlooked. Placing the applicant on the left side in the recumbent position frequently brings out a diastolic or presystolic murmur inaudible under other conditions. In some cases, as is well known, exercise brings into prominence a murmur which cannot be heard when the heart is not accelerated. Many examiners have never heard a mitral murmur audible only in mid-diastole, others may never have recognized the more common presystolic crescendo murmur ending in the first sound. Once hav-

ing heard murmurs of these types the examiner finds their recognition easier when examining other applicants.

Although a snappy first sound has long been considered one of the signs of narrowing of the mitral orifice it is much more easily imagined at the end of a presystolic rumble than when no murmur can be heard. Bearing on this point Crummer (11) has suggested a very attractive hypothesis which thus far has not been generally accepted by cardiologists. He believes that differences in tone quality between the first sounds made by the right and left ventricles may be demonstrated much as variations between second aortic and second pulmonic sounds are determined. It is Crummer's opinion that the first sound originated by the right ventricle can be heard best at the left of the sternum in the fourth interspace; this he calls the "first sound right." Because of the rarity of lesions of the right side of the heart he considers the first sound right the normal standard against which he compares the first sound left produced by systole of the left ventricle with attendant closure of the mitral valve leaflets, heard best at the cardiac apex. Unless there is a difference in tone quality between the first sounds right and left, Crummer asserts organic mitral disease does not exist even though heart murmurs may be present. It is to be hoped further studies may demonstrate that Crummer's observations deserve more favorable consideration than has been given them.

Even though it be recognized that a large proportion of the cases of organic mitral disease showing apical systolic murmurs are doomed to progress to a condition of mitral stenosis, there remains a smaller group of mitral regurgitation cases with little or no narrow-

ing of the mitral ring and with little tendency to progress unfavorably. Recognition of these cases is possible only through observation over a long period of years by competent examiners. In a recent personal communication Dr. T. Stuart Hart stated:

"A very important feature to my mind is the question of the duration of the murmur. The longer this has existed without evidence of cardiac derangement the less significance should be attached to the murmur. The applicant usually thinks that a recently developed murmur is of less importance than one of long standing and his statements are apt to be colored in this direction. When such a murmur is of recent development I usually make it a point to postpone the decision until a longer period has elapsed."

The assumption is not unwarranted that the favorable mortality of mitral regurgitation cases at the older ages, especially beyond age fifty, reported to this Association by Dr. Rogers and Mr. Hunter (12) in 1924, was due to the inclusion of a high percentage of nonprogressive types; the progressive types having been eliminated by becoming frank cases of mitral obstruction or having died before reaching the sixth decade. It would appear that to make a diagnosis of uncomplicated mitral regurgitation and to issue insurance accordingly, especially to applicants at the younger ages, basing the diagnosis solely upon customary insurance examinations all of recent date is a hazardous underwriting procedure.

Apical systolic murmurs not due to disease of the mitral orifice are being recognized increasingly. Elimination of these cases from the class diagnosed uncomplicated organic mitral regurgitation, while desirable, will further increase the excess mortality ratio of the latter group. Textbooks tell us that murmurs sys-

tolic in time, inconsistent in character, not increased by exercise, not associated with a change in the character of the first sound, with no accentuation of the pulmonic second sound, without demonstrable associated cardiac hypertrophy or evidence of cardiac distress, in the absence of a history indicating any cause of heart damage, may be considered functional or nonorganic.

Unfortunately the human element in the interpretation of these signs leads to considerable error. Occasionally, also, early or mild cases of valvulitis occur with only the signs generally recognized as indicative of a functional condition. Hirschfelder (13) believes much valuable information regarding the nature of an apical systolic murmur may be obtained by observing the period of time during which the murmur is audible. It has been his observation that "a short puff" following systole is usually indicative of a functional condition provided the heart is normal in other respects, while a long murmur is presumptive evidence of valve damage.

Attention has been directed by clinicians to the occurrence of functional murmurs in association with disease conditions not affecting the heart directly. However, it would appear improbable that such an association of impairments could increase materially the mortality of those insured with cardiac lesions since the underlying extra cardiac condition if sufficiently serious to affect the applicant's insurability would be detected in most instances by the examiner.

Functional apical systolic murmurs when unassociated with any other abnormality are considered trivial and not to require substandard ratings.

If we have been combining numbers of uninsurable cases of mitral valvulitis with other groups having the

misfortune to exhibit functional murmurs but nevertheless standard risks, and with the occasional case of nonprogressive uncomplicated mitral regurgitation, thereby obtaining a mortality experience of approximately 200% it is apparent that considerable injustice has been done the two latter types of cases.

Owing to the lack of better or more practical aids to selection, it is suggested whenever a history of rheumatism or heart disease is obtained by the examiner or through other sources, that special blanks be employed for recording in more detail than is now customary the time of the murmur, its duration in the cardiac cycle, the effect of exercise on the character of the heart sounds, the effect of various changes of posture, and evidence of cardiac distress produced by exercise. In the absence of an insurance record covering a number of years more serious attempts should be made to obtain from the applicant's personal physician accurate information regarding the duration and course of the heart lesion. In large cases or those of especial importance because of agency or other reasons, X-ray and electro-cardiograph examinations should be made.

If as medical underwriters we were to assume that apical cardiac murmurs are evidence of potential or incipient mitral stenosis until proven the contrary, medical selection would be more in accord with advanced clinical knowledge, would be more just to the individual applicant and probably more profitable to the companies we are permitted to serve.

Conclusions

Mitral valvulitis is generally of "rheumatic" origin, and when of rheumatic etiology the progress of the disease is usually unfavorable, markedly shortening the

life of the individual. In contrast to clinical experience, the history obtained by the insurance examiner cannot serve as the basis of classification of cardiac cases.

Mitral stenosis is a most serious impairment necessitating the highest substandard ratings if acceptable on any plan.

Mitral regurgitation cases because of their tendency to progress to mitral obstruction usually require practically, if not identically, the same ratings given to mitral stenosis.

Mitral regurgitation not of rheumatic origin and nonprogressive can be recognized as such only by repeated and careful observation over a period of years. Indications are that the mortality experience of such a group would be little in excess of normal.

Functional apical murmurs do not as a rule necessitate substandard ratings.

Conservatism, rather than liberality, should be the attitude of the medical director in underwriting mitral valvulitis.

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Dr. Beckett—I will call upon Dr. Gordon Wilson of the Maryland Life Insurance Company, who will open the discussion on this very excellent paper. Dr. Wilson.

Dr. Wilson—I think that Dr. Richard Cabot has issued a challenge to us in regard to the question of apical murmurs, and their unimportance in his opinion, but the medico-actuarial papers presented to this

society show that there is a very definite increased mortality in this group, and for that reason we cannot consider apical murmurs as unimportant.

Clinically, it has long been recognized that apical murmurs are generally associated with dysfunction of the mitral valve, which as a rule is primarily due to rheumatic fever, or its twin sister chorea. The high mortality of heart disease prior to age fifty is accepted today as being due to the above-named diseases, and in the age period beyond fifty this honor is shared by syphilis and arteriosclerosis, but my personal opinion is that a large proportion of the heart disease deaths that we ascribe to arteriosclerosis are probably of rheumatic origin, and my reason for thinking so is that the large number of people that I have studied in the almshouse and later at autopsy, who have shown extreme atheromatous changes in their arteries, but slight changes in the heart either at autopsy or in its function prior to death.

It is well to recall certain old clinical and pathological facts for they are, as a rule, the foundation stones on which we build, and though we often tear down the superstructure and rebuild, yet we rarely disturb the foundation. Rheumatic fever is practically always a disease not simply of the joints but also of the heart, and the involvement of the heart is not an endocarditis but a carditis, since the myocardium is practically always involved as well as the endocardium, and it is probably the myocardial involvement rather than the endocardial that is a cause of the high delayed mortality from rheumatic fever. Pathologists have always recognized that the characteristic lesion in the heart resulting from rheumatic fever were the Aschoff's bodies found in the myocardium, and

which resulted in destruction of the muscle fiber and its replacement by fibrous tissue. These bodies are never found in the heart muscle in cases of endocarditis secondary to other diseases than rheumatic fever and chorea. If we recall the physiological characteristic of heart muscle, namely rhythmicity, excitability, contractility, tonicity and conductivity we will realize at once how very important is such destruction of muscle fibers by Aschoff bodies, as it is like cutting a section from a telegraph wire, which destroys not only the part cut, but renders useless the whole circuit.

Years ago Stephen Mackenzie pointed out that amongst adults who had one attack of rheumatic fever, more than fifty per cent had a valvular heart lesion; in those having had two attacks more than sixty per cent, and in those having had three attacks more than seventy per cent. Undoubtedly, there were a number who showed no signs of a valvular lesion, but whose myocardium had been invaded by Aschoff bodies and would perhaps many years later show evidence of heart weakness.

That the heart can be seriously damaged and yet later show practically no signs of such damage is well known to every clinician of much experience. I recall one case that illustrates this. A short time ago I very carefully examined the heart of a boy eighteen years of age, and on examination could find no evidence of any abnormality save a systolic blow at apex so faint that I would not have heard it had I not known that he had had a severe endocarditis. The murmur was not transmitted, there was no cardiac enlargement as shown by percussion, and there was no accentuation of the second pulmonic sound. I had at-

tended this boy when he was age seven suffering from a severe rheumatic fever, and an endocarditis that lasted a period of months. At that time the apex was near the anterior axillary line, and there was visable pulsation over the whole precardium, and the classical signs of a mitral insufficiency with dilitation. During the period of his endocarditis his pulse at times was markedly irregular, which I would now recognize as an auricular fibrillation. Finally, convalescence was established, and a very wise mother, and a very wise father strictly enforced the advised long period of rest, rest over a period not of weeks but of months, in fact years. If that boy should be examined today by any clinician who did not know the story of that endocarditis the murmur would be diagnosed in Cabot's words as "unimportant," but to one who saw him during the endocarditis and knew the myocardial changes that must have been present at that time, the murmur could not be considered "unimportant."

I don't know of a more false statement in the impression that it gives than that of Cabot when he states that only seven cases out of more than eighteen hundred showed any mitral regurgitation at autopsy. No autopsy on earth can show whether the mitral valve is competent or not, since the competency of the valve, as such, depends upon two factors: First that the aperture shall be small enough to be closed by the normal valve leaflets, and second that the valve leaflets shall be normal. At autopsy the only thing that can be decided is in regard to the valve leaflets, but the size of the aperture cannot be tested at autopsy, since its size depends upon the integrity of the muscle fibres that surround the aperture, and their ability to function normally. If through failure of these muscle

fibres the aperture is not contracted sufficiently to be closed by the normal leaflets we will get a regurgitation of blood from the ventricle to the auricle, and with this regurgitation of the blood get our classical physical signs, and yet have normal leaflets, but nevertheless, the patient will eventually die from the failure of the mitral valve even though the pathologists and Dr. Cabot say that it is not diseased.

I do love a fight, and I will always fight when a pathologist tells me there is no mitral regurgitation present in a heart that he is examining when I have examined that same heart in life and found the apex well out towards the axilla, cardiac dullness increased to right and left, a systolic murmur at apex transmitted outwards and upward with accentuation of the second pulmonic sound, and the signs elsewhere of decompensation. So much for that.

What are the evidences that indicate that an apical murmur is harmless? In the first place no apical murmur is harmless in an applicant aged fifty or more. In young applicants I think that the most important indication of harmlessness is a failure of the murmur to be intensified or further transmitted by exercise, especially if the murmur disappears with exercise. Next comes the size of the heart, but my experience is that relatively few examiners are capable of accurately estimating the size of the heart, and still fewer can do it in the older applicants who are slightly overweight or deep chested. Another important characteristic of functional murmurs is that while heard in the upright position they are not heard in the recumbent position, but I have seen many cases of organic murmurs that had this characteristic, but they did not have the first characteristic noted above of harmlessness as shown

by a failure to be accentuated by exercise. Whether a murmur is transmitted or not is of little importance if that murmur is intensified by exercise.

I agree with Dr. Johann's conclusions, save in one particular, and that is he would rate mitral insufficiency on account of its becoming later mitral stenosis, following the false reasoning of Cabot, and I would rate it because the mitral insufficiency showed a damaged myocardium, and our clinical experience has shown us that just a few fibers damaged may result in serious disease, as is seen when the bundle of His becomes involved and heart block results.

In our mortality studies concerning the heart we must realize that a damaged myocardium may exist for years before dysfunction and death result, and for that reason a normal expectancy is frequent over a period of five or ten years, but is then followed by a sharp rise in the mortality, and for that reason the final proof of any tests that we now have that would measure cardiac efficiency can only be known by actuarial studies after a period of ten or more years.

Dr. Beckett—I think the Society is greatly indebted to Dr. Wilson for this most splendid address. Is there anyone else that would like to discuss this paper? Dr. Wenstrand, of the Northwestern Mutual Life Insurance Company.

Dr. Wenstrand—It is a great satisfaction to listen to and to read the more recent papers on heart murmurs as related to risk selection, especially to one who belongs to a medical department which has believed for over twenty years that there is a distinction between organic and nonorganic systolic murmurs. The Northwestern has accepted applicants with what have

been considered nonorganic systolic murmurs since 1905.

The paper under discussion today in this connection, and at the Seventeenth Annual Meeting of the Medical Section of the American Life Convention, Doctors White, Grosvenor, Frost and Cook shared in a symposium on apical heart murmurs. There has been a very decided change in the point of view toward this subject when compared with that of the more or less recent past. This change is fortunate for it coincides more nearly with the modern conception heart pathology. As Doctor Cook said in his presentation last May: "It seems incomprehensible that we continued holding to the misconception decade after decade, while the best men in the profession were listening to these hearts in the wards and studying them at the postmortem table." He had in mind the former medical impairment heart codes, which were based on attempts at diagnosis of the various valvular lesions, and those studies, undertaken from this same fallacious starting point, which assumed the diagnosis from the location of the murmur.

At the 29th meeting of this Association in January, 1919, Doctor Fisher made a preliminary report on a group of 770 cases, which had been accepted by the Northwestern Mutual Life Insurance Company, where a systolic murmur was present at the time of the examination or where there was a history of a heart murmur (the old code 307) in the past. At the time it was recognized that the group was small and not entirely homogeneous, but it gave us some notion concerning our selection of this class, and encouraged us to continue. In connection with the present dis-

cussion, it may be interesting to refer again to this group, with our results brought down to 1924.

We believe that the important factor in differentiating between acceptable and not acceptable applicants is the decision as to whether the systolic murmur is organic or nonorganic. The place where the murmur is heard is, to us, not so important and we have formulated the following rules to govern our selection:

1. Systolic in time, but heard either at apex or at base.
2. No diastolic murmurs (including presystolic) of any kind.
3. Not transmitted toward the left.
4. Apex beat in normal area.
5. No other evidence of hypertrophy.
6. No accentuation of 2d pulmonic tone.
7. No abnormality of pulse rate or rhythm.
8. Arterial tension normal.
9. Reaction of pulse to exercise normal.
10. No history of inflammatory rheumatism, definitely infected tonsils or other infections.
11. Examination made either at home office or by an examiner of well-known ability and judgment.

Of late years, we have used a special heart blank in getting this information and have become somewhat more daring in accepting these from our examiners quite generally. In certain of the larger cities, we have designated men as "heart experts," selected very carefully, to whom doubtful cases are referred for examination and opinion.

In the study there are 2,669 individual cases which have been divided into four groups:

1. Murmur reported previously but not found at the time we assumed the risk.
2. Nonorganic systolic murmur found at time of examination by a regular examiner.
3. Nonorganic murmur found by "Heart Expert" or at Home Office.
4. Heart enlargement reported previously, but not found at the time we assumed the risk.

The objection may again be raised that the class, as a whole, lacks homogeneity, but it must be borne in mind that oftentimes nonorganic murmurs are inconstant, so it may be assumed that Group 1 contains many cases of this kind. Last winter I heard Doctor Robert Bruce Preble of Chicago make the statement that, if one listens long enough and often enough, a nonorganic systolic murmur may be heard at some time in almost every individual. Group 4 does not definitely belong in the class, but there are only 96 cases (3 1/2%), so it does not affect the total results to any great extent.

Without further preliminaries, though I realize that there are other points which might be gone into, let me refer briefly to the tables which, with the permission of the publication committee, will be given in full in the transactions. Parenthetically and for the sake of comparison, it may be said that the company's general mortality, during approximately the same period and by the same Mortality Table, namely the "American Men," was about 79% or perhaps a little less (issues 1906 to 1915, studied to anniversaries in 1920—78.75).

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY

HEART MURMUR MORTALITY—RISKS ACCEPTED—ISSUES OF 1905-1923 TO ANNIVERSARY IN 1924—AMERICAN MEN TABLE

All Ages

Group Number	First 5 Years			After 5 Years		All Years	
	No. of Lives	Expected	Actual	Expected	Actual	Expected	Actual
1	1579	31.31	36	33.33	31	64.64	67
		111.77%		93.01%		103.49%	
2	749	13.95	12	8.85	1	22.80	13
		86.02%		11.29%		57.01%	
3	245	3.40	3	1.41	0	4.81	3
		88.23%		0%		62.37%	
Total 2 & 3	994	17.35	15	10.26	1	27.61	16
		86.46%		9.75%		57.95%	
4	96	1.95	0	.44	0	2.39	0
		0		0		0	
Total	2669	50.61	51	44.03	32	94.64	83
		100.77%		72.65%		87.71%	

1. Murmur previously reported, but not found at the time we assumed the risk.

2. Non-organic murmur found at time of examination.

3. Non-organic murmur found by Heart Specialist or at Home Office.

4. Heart enlargement reported previously, but not found at the time we assumed the risk.

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HEART MURMUR MORTALITY—RISKS ACCEPTED—ISSUES OF 1905-1923 TO ANNIVERSARY IN 1924—AMERICAN MEN TABLE

Ages Under 40

Group Number	First 5 Years			After 5 Years		All Years	
	No. of Lives	Expected	Actual	Expected	Actual	Expected	Actual
1	1085	15.84	23	15.52	20	31.36	43
		145.21%		128.87%		137.11%	
2	557	7.96	7	5.01	0	12.97	7
		87.94%		0%		53.89%	
3	192	1.92	1	.82	0	2.74	1
		52.08%		0%		36.49%	
Total 2 & 3	749	9.98	8	5.83	0	15.71	8
		80.97%		0%		50.92%	
4	64	.95	0	.37	0	1.32	0
		0%		0%		0%	
Total	1898	26.67	31	21.72	20	48.39	51
		116.23%		92.08%		105.38%	

1. Murmur previously reported, but not found at the time we assumed the risk.

2. Non-organic murmur found at time of examination.

3. Non-organic murmur found by Heart Specialist or at Home Office.

4. Heart enlargement reported previously, but not found at the time we assumed the risk.

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY

HEART MURMUR MORTALITY—RISKS ACCEPTED—ISSUES OF 1905-1923 TO ANNIVERSARY IN 1924—AMERICAN MEN TABLE

Ages 40 and Over

Number	First 5 Years			After 5 Years			All Years		
	No. of Lives	Expected	Actual	Expected	Actual		Expected	Actual	
1	494	15.47	13	17.81	11		33.28	24	
		84.67%		61.76%			72.12%		
2	192	5.99	5	3.84	1		9.83	6	
		83.48%		26.04%			61.04%		
3	53	1.48	2	.59	0		2.07	2	
		135.81%		0%			91.61%		
Total 2 & 3	245	7.47	7	4.43	1		11.90	8	
		93.71%		22.57%			67.23%		
4	32	1.00	0	.07	0		1.07	0	
	0%			0%			0%		
Total	771	23.94	20	22.31	12		46.25	32	
		83.54%		53.78%			69.18%		

1. Murmur previously reported, but not found at the time we assumed the risk.

2. Non-organic murmur found at time of examination.

3. Non-organic murmur found by Heart Specialist or at Home Office.

4. Heart enlargement reported previously, but not found at the time we assumed the risk.

THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY

DEATHS IN GROUPS 1, 2, 3 OF HEART MURMURS MORTALITY CLASSIFICATION

	GROUP 1		GROUP 2		GROUP 3		TOTAL ALL CAUSES	
CAUSES OF DEATH	Ages under 40	Ages 40 & over	Ages under 40	Ages 40 & over	Ages under 40	Ages 40 & over	Ages under 40	Ages 40 & over
Accident	4	0	0	0	0	0	4	0
Actinomycosis	1	0	0	0	0	0	1	0
Anemia—pernicious	0	1	0	0	0	0	0	1
Angina pectoris	0	1	0	0	0	0	0	1
Apoplexy	0	4	0	1	0	0	0	5
Bladder rupture	1	0	0	0	0	0	1	0
Brain tumor	0	0	0	0	0	1	0	1
Cancer	1	3	1	2	0	0	2	5
Coronary thrombosis	0	0	0	0	0	1	0	1
Diabetes	0	0	0	0	1	0	1	0
Encephalitis	0	0	0	1	0	0	0	1
Epilepsy	1	0	0	0	0	0	1	0
Heart Disease	12	3	0	2	0	0	12	5
Hodgkin's disease	1	0	0	0	0	0	1	0
Leukemia, acute	0	1	0	0	0	0	0	1
Nephritis	1	2	1	0	0	0	2	2
Paralysis, general	1	0	0	0	0	0	1	0
Pneumonia & Influenza	12	4	3	0	0	0	15	4
Stomach, Ulcer	0	2	1	0	0	0	1	2
Sudden Death	1	1	0	0	0	0	1	1
Suicide	3	1	0	0	0	0	3	1
Syphillis	0	0	1	0	0	0	1	0
Tuberculosis	3	0	0	0	0	0	3	0
Typhoid	1	0	0	0	0	0	1	0
Unknown cause	0	1	0	0	0	0	0	1
Total	43	24	7	6	1	2	51	32

As shown above, 19 died from circulatory diseases, which is 23% of all deaths. In comparison, the Company's general experience, during approximately the same period, shows that 17% of all deaths were due to circulatory diseases. The same number, namely, 19, died as a result of pneumonia and influenza. Of these deaths, 8 occurred during the flue epidemic from October, 1918, to March, 1919.

Dr. Beckett—Is there any other person that would like to speak on this subject? If not, I will ask Dr. Johann to close the discussion.

Dr. Johann—To attempt to add to the excellent discussions of Dr. Wilson and Dr. Wenstrand, I am afraid, invites an anticlimax. Dr. Wenstrand states that he had not received a copy of the paper before

coming to the meeting, and my own experience bearing this out leads me to believe that a great many of the men who have come from the west have had no opportunity to read the papers, any of them, that are in the blue booklet we have. For fear that a good many of the men may not know what the paper was that has been discussed, I am going, with your permission, to summarize it just briefly.

In the paper, the term rheumatism is used in its broad sense to cover any focal infection of a chronic nature that is leading to insults of a physical nature elsewhere in the body. Some figures were presented to show that practically all cases of organic heart disease developing in the younger ages are of rheumatic origin when you consider rheumatism as has been defined. An attempt was made also to show that the characteristic of rheumatic cardiac involvement, rheumatic carditis as Dr. Wilson has described it, is a tendency to the development of mitral obstruction as years go on. It has been our experience as medical underwriters that we cannot depend on a negative history of rheumatism in diagnosing this condition for two reasons: wilful deception on the part of the applicant and lack of knowledge of the presence of a chronic focal infection that is leading to trouble.

If rheumatic carditis eventuates in mitral stenosis—and it has been the experience of practically all medical underwriters that mitral stenosis cases are undesirable as risks—is it not logical to presume that the early stage of mitral valvulitis, which we have so frequently heard described to us as mitral regurgitation, is an indication of an extremely serious impairment and that the frequency of complicating stenosis, which causes death, in so many of the cases is much greater

than our examiners have described to us. I believe that the failure to find evidence of stenosis is partly due to the mental attitude with which the examiner approaches the examination. He concentrates on systole, expects to find the murmur there and consequently he finds it only in systole.

I think the most important factor to take into consideration in estimating the seriousness of the mitral systolic murmur is, as mentioned in the paper, the time element. A systolic mitral murmur that has lasted for a long time—when we have reliable information through insurance records or through physicians that this condition has existed a long time without evidence of complications—is a relatively safer type of murmur than one of recent origin. I think the figures cited by Dr. Rogers and Mr. Hunter in 1924 bear this point out exceedingly well. Individuals with systolic apical murmurs considered uncomplicated have a favorable experience in later years, probably due to the fact that the progressive types have died off before they reached that age.

I wish to thank those who have discussed the paper and to express the hope that further studies may make it possible to differentiate more clearly between the nonprogressive types of organic mitral lesions and those which lead to an early death due to their further development.

Afternoon Session

Dr. Beckett—Will the Association please come to order?

The next paper on the program is "Cardio-Respiratory Test Experience of First Five Years," by Dr. H. M. Frost of the New England Mutual Life Insurance Company.

THE CARDIO-RESPIRATORY TEST: ANALYSIS OF EXPERIENCE FOR THE FIRST FIVE YEARS

by HAROLD M. FROST, M. D.

Assistant Medical Director, New England Mutual Life Insurance Company

At the thirty-third annual meeting of this Association, November, 1922, I presented a paper on the study of cardio-vascular reaction to variation of intra-thoracic pressure. I described the technique of a new test, which had originated in the Medical Department of the New England Mutual; the Cardio-Respiratory Test.

For the previous ten months we had been developing the technique, and observing the reaction to it of the apparently normal circulation. The test had been applied to a few individuals with circulatory impairment. The results were suggestive, but did not warrant the claim that this was a real test of circulatory integrity. We hoped that it would so prove itself. We decided to persist in the study of it, until we had satisfied ourselves as to its merits.

We have been using it, to an ever-increasing extent, in the attempt to determine the insurability of risks with known, or suspected, circulatory impairment. At the end of five years, it is fitting that we should publish our experience. We may reasonably be expected to have arrived at a justifiable opinion, though not necessarily final. This is the purpose of this discussion.

To illustrate our experience more pointedly, I have set apart for study the records of 3,500 applicants, to

whom the test has been applied. There has been no attempt to select these in order to increase the number of major circulatory impairments; or to eliminate the unsatisfactory reactions, or those cases in which the test was applied for reasons other than apparent, or even suspected, impairment of the circulation.

These cases have been taken in the order of application for insurance; for a definite reason. I wish to show the actual operation and results of the application of the test, under practical working conditions, throughout our entire company organization. With but few exceptions, the applicants were examined during the four years from the Fall of 1922 to the Fall of 1926.

I propose to consider first the development of the test and the system by which it was introduced to our agencies. I shall then discuss briefly our present technique, and the interpretation of the reaction. Finally, I shall give a rather general analysis of our results.

I

Development of Cardio-Respiratory Test

Origin of Test

In December, 1921, Dr. Dwight broached to me a problem which he had been pondering for some time, and enlisted my aid in an effort to solve it. He believed that if a practical method of evaluating circulatory efficiency could be developed, we might safely accept, on standard plans, a considerable number of

the applicants with circulatory impairments whom we were then declining outright. He did not feel that the tests then available were satisfactory. He described a fluctuation of systolic pressure which had resulted in his own case, while blowing against a Tycos sphygmomanometer gauge, and suggested that by working along similar lines it might be possible to develop a satisfactory test.

I assembled a Simplex spirometer with a compound steam gauge and proceeded to try out various respiratory stunts, while another examiner observed the nature of the fluctuations of my systolic pressure. Certain stunts appeared to result in marked pressure variations and were combined to form a tentative technique. During the next six months, this was applied to one hundred of the members of the Home Office staff, who had no obvious circulatory impairment. Gradually the Cardio-Respiratory Test was evolved, as described before the Association in November, 1922. A few changes in apparatus, technique and interpretation have been made during the ensuing five years which will be discussed later.

Introduction of the Test to Our Agencies

During the Spring and Summer of 1922, the test was applied at the Home Office to about 30 applicants. In the Fall it was introduced to our agency at New York City. In the Spring of 1923, it was introduced to our agencies east of the Mississippi and north of Mason and Dixon Line; in the Fall of 1923, to the South. In 1924-25, it was extended to the West. It is now in use in all but three of our General Agencies, and in most of our District Agencies; 69 in all.

In 1922, the tests were made at the rate of 9 per

month; in 1923, 60 per month; in 1925, 96 per month. During this year, we have received them at the rate of 129 per month.

Proficiency of Examiners

At present, 110 of our examiners are authorized to apply the test. With a few exceptions, these are all Chief Examiners. In some of the larger cities, where on account of the larger volume of business the Chief Examiner is frequently unavailable, and in a few instances where the Chief Examiner has not readily mastered the technique of the test, the use of alternate examiners of proved ability has been authorized.

In order to give an idea of the facility with which these examiners have acquired the technique, I have rated them according to their performance as follows:

A	(very good)	12	10.9%
B	(good)	60	54.5%
C	(fair)	21	19.0%
D	(poor)	17	15.5%

The Class A examiners are outstanding for the promptness, thoroughness and apparent ease with which they grasped the technique; and the continued excellence of their reports.

The Class B examiners have taken more time to master the test; have rendered reports which obviously indicated errors of technique; but after persistent practice, and in some cases coaching by correspondence from the Home Office, have become proficient.

The Class C examiners have been slow in mastering the test; have made many errors of technique, often repeatedly; have required considerable coaching; but have eventually attained a degree of profi-

ciency which commands our confidence. This was due in part to the fact that we were not able to give them the usual amount of preliminary instruction. Many of them are associated with smaller agencies, without occasion to apply the test often enough to become proficient quickly.

The Class D examiners have never proved to our satisfaction that they were able to apply the test. Four of them are men along in years; apparently so fixed in their mental processes that they cannot adapt themselves to the requirements of the test. In their area, we are obliged to rely upon competent alternates. Another four, apparently very able clinicians and in their prime, are unable to give the test properly. We assume that this is due to lack of interest and lack of practice. The remaining nine have had but little occasion to use the test and perhaps have lost their interest. Some of them have had no suitable preliminary training.

The most satisfactory method of teaching the examiners has been personal instruction and demonstration by one of us from the Home Office. A few examiners have learned without instruction. A few have attempted this without success. A few have been taught by other examiners; in some cases successfully; in others, not so. On the whole, a couple of hours of description and demonstration, with the pupil giving the test for his first time under direct supervision, have proved most satisfactory.

Summing up, 84.5% of the examiners selected have mastered the test to our satisfaction. Of these, 10.9% have done so quickly; 54.5%, reasonably quickly; 19.0% slowly, with difficulty. 15.5% have never acquired the technique sufficiently to inspire our confi-

dence. In the case of most of these latter, we have authorized the use of alternates who are satisfactory.

Expense of the Test

The apparatus is supplied by us. The old type, the Simplex spirometer and Tycos gauge, costs about $28.50. The newest Tycos apparatus costs from fifty to sixty dollars. We pay the examiner a fee of $5.00 for each test. As a rule we require in addition a complete microscopic analysis of the urine by one of our chemists. This entails another $5.00 fee. A complete examination may cost us from fifteen to twenty dollars.

Authorization of the Test

As a rule the test is applied only when authorized by the Home Office. We have found this necessary to curtail expense.

Naturally, we are receiving requests for consideration of risks with circulatory impairments to a far greater extent than before the introduction of the test. Risks who have been repeatedly declined or rated by other companies are referred to us. We do not object to this at all. We are willing to treat each case on its merits, regardless of the action of other companies.

A small proportion of these, however, is obviously uninsurable, as indicated by the information on file at the Home Office. We do not care to incur the expense of a complete examination in a hopeless case. Another proportion is very doubtful. Before going to the expense of a complete examination, we prefer to have the test given as a preliminary procedure. If this proves satisfactory, the remainder of the examination is then authorized.

Whenever the agent is aware of any doubt as to the circulation of a prospective applicant, we insist that a preliminary request for consideration be submitted. We are then able to use our judgment as to how to proceed.

If an examiner who is qualified to give the test discovers a circulatory impairment during a routine examination, he is allowed to use his judgment as to the immediate application of the test. If another examiner detects such an impairment, the applicant is referred by us to the Chief Examiner for the test and other necessary examination.

II

Technique

Apparatus .

The original apparatus consisted of a Simplex spirometer and a compound steam gauge. The gauge was heavy and cumbersome. We aroused the interest of the Taylor Instrument Companies, who responded handsomely by assembling a small light Tycos vacuum-pressure gauge. We have used this since.

The original manufacturer of the Simplex spirometer died. We were faced with an exhaustion of supply. Again the Taylor Instrument Companies came to our relief, inventing a new spirometer. They have improved this from time to time, until it appears to be very satisfactory.

The present apparatus may be obtained at a retail cost of $60.00. Full directions for assembling accompany each set. It is compact and easily manipulated. It is claimed to give accurate readings of the vital capacity.

Present Technique

I do not intend to review the entire technique of the test. This has altered somewhat, since the original description in November, 1922. The change from the steam gauge to the Tycos gauge involved the change from pressures estimated in pounds to those of centimeters of mercury. Certain practical points have been discovered from time to time, which facilitate the application of the test. For the details of these, reference may be made to "Life Insurance Medicine," Vol. I, published by the New England Mutual, or to the "Boston Medical and Surgical Journal," Vol. 191, No. 19, p. 853. Either of these articles gives an accurate description of the present technique except for one important alteration.

In June of this year, we omitted Step Five, substituting for it another step identical with Steps Six, Seven and Eight. We had become convinced that Step Five, which consisted of inhaling against the gauge to the extent of 2.5 centimeters of mercury, could not be properly done by a large proportion of the subjects. We did not believe it would ever give us any information of value. In our present technique, therefore, Steps Five, Six, Seven and Eight are exactly the same; consisting of expiration to the full vital capacity through the spirometer at a pressure of 2 cm. Hg.

With the old technique, we frequently observed an insufficient rise of systolic pressure in Step Eight, although the rise in Steps Six and Seven had been satisfactory. This left us in doubt as to whether we were faced by an artefact or by an indication of abnormal response. Now, with four of these steps, we have less difficulty in this respect.

III

Interpretation

Five years ago we had arrived at a conception of the normal reaction to the test; but had not sufficient experience with impaired risks to have formed any definite opinion as to the abnormal reactions. Today we have our opinion as to these, which it will be worth while recapitulating. It is only fair to say that the following summary constitutes my own opinion. While we are in accord as to the major constituents of the abnormal reaction, there are a few atypical elements as to the significance of which we do not agree.

The Normal Reaction

Our opinion as to the normal reaction has not altered to any considerable extent within these five years. The original was based upon the study of one hundred apparently normal individuals. Since then Dr. H. H. Amiral and I have tested a number of medical students and Dr. R. P. Dawson and I have tested athletes at Harvard University. The following represents our present ideas as to the normal limits of fluctuation of the systolic pressure (Plate I, Chart I):

In Steps Two and Four, the pressure should fall at least 10 mm. Hg. and may approximate the diastolic level. In Step Three, it should increase to a point not exceeding 20 mm. Hg. above the base-line. In Steps Five, Six, Seven and Eight, it should increase to a point at least 20 mm. Hg. above the base-line but not more than 50 mm. Hg. The base-line pressure should not drop more than 5 mm. Hg. below its original level,

nor increase more than 10 mm. Hg. The base-line should be fairly steady, without extreme fluctuations. There should be no marked decrease of pulse pressure or marked increase of pulse rate. The capacity blown in Steps Five, Six, Seven and Eight should not be unduly low and should show no marked tendency to decrease from Step to Step.

The Hypoactive Reaction

This we consider an abnormal reaction. It has seven characteristics, which are found in various combinations. Rarely are all of them present in a single reaction. The more of them we find, the more abnormal we consider the reaction. They are as follows:

(1) Insufficient rise of systolic pressure in Steps Five, Six, Seven and Eight (Plate II, Chart I). In this case, the pressure fails to rise 20 mm. Hg. above the base-line.

(2) Insufficient fall of pressure in Steps Two and Four (Plate II, Chart II). The pressure does not fall to the minimum of 10 mm. Hg. below the base-line. We are at a loss to understand this phenomenon. It occurs rather frequently, and under conditions which satisfy us that there has been no error in technique.

(3) Progressive decrease in the maximum pressure attained in Steps Six, Seven and Eight, as compared with that of Step Five (Plate II, Chart III).

(4) The falling base-line (Plate II, Chart IV). See also Plate I, Chart II, Curve A. The base-line falls gradually to a point more than 5 mm. Hg. below the original level.

(5) The markedly decreasing pulse pressure (Plate

III, Chart I). We consider a decrease of pulse pressure in excess of 10 mm. Hg. to be abnormal.

(6) The markedly increasing pulse rate (Plate III, Chart I). We accept ten points as the normal limit of increase in pulse rate.

(7) The gradual decrease of capacity blown in Steps Six, Seven and Eight as compared with that of Step Five (Plate III, Chart I). In addition, we consider abnormal a vital capacity which is obviously too low for the build of the subject.

To illustrate these characteristics more concisely, attention is called to a fictitious reaction, Chart I, Plate III, which embodies all of them.

The Hyperactive Reaction

We consider this an abnormal reaction. Its chief characteristic is an excessive increase of systolic pressure in Steps Five, Six, Seven and Eight; to a point more than 50 mm. Hg. above the base-line (Plate III, Chart II).

The Irritable Reaction

This also we believe abnormal. It occurs frequently in conjunction with hyperactivity (Plate III, Chart III). It has five characteristics as follows:

(1) The excessively fluctuant base-line (Plate III, Chart III). See also Curves D and E, Chart II, Plate I.

(2) The base-line rising to a point in excess of 10 mm. Hg. above its original level (Plate III, Chart III). See also Curve F, Chart II, Plate I.

(3) Increasing systolic and diastolic pressures (Plate III, Chart III).

(4) Increasing pulse pressure (*Idem*).

(5) Increasing pulse rate (*Idem*).

The Hypertensive Reaction

The plane of this reaction is raised sufficiently to bring the base-line into the realm of hypertension. The fluctuations of pressure in the various steps may conform to the normal limits. Again, the reaction may embody various combinations of the abnormal characteristics described in the three previous reactions (Plate III, Chart IV).

Significance of Abnormal Reactions

The hypoactive reaction is the most frequently encountered. We consider it, when well pronounced, a probable indication of serious impairment of the cardiovascular system; of circulatory inability to withstand extra strain. As such, it calls for outright declination of the risk.

The irritable reaction comes next in the order of frequency. It indicates a circulation which for some reason has begun to deteriorate; has become unstable; functions spasmodically. If the characteristics are marked, declination is indicated. If they are of minor degree, the risk may be acceptable for modified plans of insurance.

The hyperactive reaction is not so frequently found. It testifies to an over-acting, spendthrift circulation, which gradually depletes its reserves and will probably deteriorate prematurely. It is frequently associated with the irritable characteristics. If it is well marked, declination of the risk is in order. Otherwise, the risk may be accepted for modified plans.

The hypertensive reaction is abnormal only in that

it indicates a state of increased systolic blood pressure. Its gravity depends upon the degree of this increase; and in addition, upon the nature of any of the other abnormal characteristics which are associated with it.

It may be emphasized again that the reaction of any individual may conform strictly to one of the foregoing types, or may embody various combinations of the characteristics of any of them.

Base-Line Variations

(1) *The normal base-line.* This is expected to fluctuate a few millimeters from Step to Step. It may rise gradually to a point not in excess of 10 mm. Hg. above the original level; or may fall not more than 5 mm. Hg. It should be fairly steady, however; with no marked fluctuations (Plate I, Chart II, Curve C).

(2) *The falling base-line.* There are two types. The one falls gradually to a point more than 5 mm. Hg. below the original level. It is abnormal; a characteristic of the hypoactive reaction (*Idem,* Curve A). In the other, the fall occurs between Steps One and Two, and thereafter the base-line maintains a satisfactory level. This is found in the reaction of excited subjects, and usually represents an alleviation of excitement. It is not necessarily abnormal. The base-line should be considered as beginning at the level found in Step Two (*Idem,* Curve B).

(3) *The irritable base-line.* This is abnormal. It has two characteristics. One is the tendency to extreme fluctuation. This may occur within the upper and lower limits which have been set for the normal base-line (*Idem,* Curve D). The other is a rise to a point more than 10 mm. Hg. above the original level (*Idem,* Curve F). This may be associated with an abnormal fluctuation (*Idem,* Curve E).

IV

Analysis of 3,500 Cases

As previously stated, these cases have been taken in the order of their examination during the years 1922 to 1926. To avoid the confusion of a multiplicity of details, I shall discuss them in a rather broad, general fashion; describing what has been done, rather than the minutiae of the reasoning which has prompted us.

The analysis covers a total of 3,500 applicants. Of these, 2,022 (57.7%) were accepted, giving satisfactory reactions to the Cardio-Respiratory Test.

The declined amounted to 1,478 cases (42.3%). Not all of these, however, were declined because of abnormal reactions. One hundred forty-nine of them, 4.3% of the total number of applicants, gave normal reactions; but were declined for other reasons. The number declined because of abnormal reactions, therefore, was 1,329, or 37.9%.

A total of 4,034 tests was given. Of these, 44.2% were abnormal. Of the 3,500 applicants, 62.1% gave normal reactions; 37.9%, abnormal.

The distribution of the 3,500 applicants by 10 year age groups is as follows: 15-24, 15.8%; 25-34, 32.3%; 35-44, 27.6%; 45-54, 17.3%; 55 and over, 7.0%. Practically 60% of them were in early and middle adult life; ages 25-44. Comparatively few of them had attained advanced ages.

To the 2,022 accepted risks were issued 2,137 policies, to the amount of $19,191,724. The amount of the average policy was $8,981; considerably larger than the average policy issued for our general business. As would be expected, the size of the policies issued to the

younger applicants was notably less than in the case of the older; increasing consistently with advancing age at entry. The various forms issued, with the percentage of each by number and amount, and the average size of the policies, were as follows:

	% by Number	% by Amount	Average Size of Policy
Ordinary Life	34.5	47.8	$12,377
Limited Payment Life	11.0	7.6	6,155
Modified Life	7.9	6.3	7,222
Endowment, less than 20 years	5.7	4.6	7,322
Endowments, 20 years and over	27.6	18.4	5,997
Term, Five year	13.2	15.3	10,950
All policies	$19,191,724		$8,981

The following table shows the varying proportion of the different forms of policies issued, according to the age at entry, by ten-year age groups:

Age Groups	Ordinary Life	Lim. Pay. Life	Mod. Life	End. Under 20	End. 20 or Over	Term
15-24,	18.5%	22.9%	8.3%	1.4%	43.3%	5.4%
25-34,	30.9%	11.6%	9.0%	3.9%	31.9%	13.4%
35-44,	39.0%	6.5%	7.7%	3.4%	25.0%	18.2%
45-54,	43.7%	7.0%	6.2%	15.1%	13.4%	14.6%
55, plus	72.3%	3.2%	4.2%	12.8%	2.1%	5.3%

Evidently, the Endowment for 20 years or over, the Limited Payment Life and the Ordinary Life Modified, usually to cash value in 20 years, were the forms preferred by us for risks at the earlier ages. This reflects our effort to diminish the company risk; either by accumulating a larger reserve during the earlier years or by assuring the removal of the risk from the books before the dangerous age, as we see it, shall have been attained. With advancing age, these forms were issued progressively less, amounting at the most advanced ages to less than 10%.

The Ordinary Life and short term Endowment, on the contrary, were issued less frequently at the earlier ages, 20%; progressively more frequently with advancing age; attaining at the most advanced ages the rate of 85%. It is apparent that we are disposed, at the older ages, to issue Ordinary Life liberally, if we consider the risk satisfactory; or, if there is some doubt as to this, to limit sharply to a short term Endowment, for ten to twenty years.

In the following table are indicated the chief impairments for which the test was given; with the percentage of each to the total number of cases; the rate of acceptance, and the percentage of abnormal tests for each:

	Number of Applicants	% of Total Applicants	% Accepted	% of Abnormal Tests
Heart Murmurs	2081	59.4	56.1	45.3
Hypertension	441	12.6	35.6	70.2
Goitre	235	6.7	69.9	35.2
Irregular Pulse	170	4.9	71.7	25.1
Tachycardia	70	2.0	65.7	28.3
Hypotension	45	1.3	68.9	34.6
Hypertrophy	22	0.6	54.5	42.3
Miscellaneous	436	12.4	64.0	29.5
Total	3500	100.0	57.7	44.2

(1) The miscellaneous group forms a considerable proportion of the total; 12.4% by number to which 21.7% of the total insurance was issued. To obtain a clear idea of the variety of impairments for which we give the test, it will be necessary to describe this group more fully. 75.6% of the group consists of applicants who gave a history of circulatory impairments in the past, but showed none on examination; 56% of them being heart murmurs and hypertension.

8.1% of the group had a past history of urinary impairment; 3.0%, of severe rheumatism, without apparent involvement of the heart. 5.0% were overweights. The remaining 8.3% includes underweights; those with histories of lung disease, syphilis or other severe debilitating disease; those with a pronounced family history of circulatory disease, and three cases in which application was being made for the company's limit.

(2) It is apparent that we use the test freely whenever any serious doubt exists as to the health of the applicant in the past, even though the physical examination is satisfactory. We believe this affords us an additional check upon the completeness of recovery. It is notable that the percentage of abnormal tests, while much less than that of the 3,500 cases (29.5 : 44.2), is yet considerable; resulting in the declination of over a quarter of the impaired risks of this type. Otherwise, if selected on the basis of a normal physical examination, these would have been acceptable.

Unsatisfactory Reactions

It has occurred to me that a discussion of the unsatisfactory reactions which our examiners have submitted will present convincing evidence as to the degree of difficulty in learning and applying the test. It will also illustrate the occasional intervention of abnormal signs or symptoms on the part of the subject which necessitates the suspension of the test.

There were 200 reactions which, in my judgment, presented errors of technique or evidence of the intervention of abnormal signs or symptoms. This is 4.95% of 4,034 reactions.

Of these, 65 (30.6%) were submitted without base lines, by 26 examiners. In other words, 23% of our examiners committed this error on an average of two to three times, before the fault was corrected, usually by correspondence. One of them was particularly persistent; submitting eleven such reactions in succession, before our repeated letters of protest made the necessary impression. However, we were able to estimate the base line in most of them, accepting 58.7% of the applicants.

Twenty of the reactions (10%) were useless, presenting gross errors in technique; with atypical, meaningless curves. As a rule, these represented the initial efforts of examiners who were learning to apply the test. Lack of co-operation by the subjects was undoubtedly a factor.

In ten cases, 5.0%, the intervention of abnormal signs or symptoms interrupted the test. These abnormalities were: Syncope, twice; increase of systolic blood pressure in final steps to what examiner considered an alarming height, four cases; decrease of heart rate by approximately one-half, for a short interval (1/2-1 minute), two cases; onset of slight pain over heart, of short duration, once; onset of paroxysmal tachycardia, once.

In five cases, 2.5%, failure of the subject to co-operate was absolute.

One hundred of the reactions (50%) presented other errors of technique. These consisted mainly of the introduction of hypoactive characteristics which were apparently contradicted by the remainder of the reaction, according to my standard of interpretation. These errors may be attributed in part to the examiner; in part to lack of co-operation by the appli-

cant. A considerable portion were of minor importance; so much so that we felt justified in accepting 43% of the applicants in the group.

Summarizing, two hundred reactions (4.95% of 4,034) have not been satisfactory. Ten of these (0.24% of 4,034) were incomplete because of the intervention of abnormal signs or symptoms. The remainder, 190 (4.7% of 4,034), have shown errors of technique.

Of this latter group, 25 (0.6% of 4,034) have been useless; 5 (0.12% of 4,034) because of lack of cooperation by the applicant; 20 (0.48% of 4,034) because of gross errors of technique, mainly on the part of the examiner. The remaining 165 (4.0% of 4,034) have presented apparent errors of technique on the part of both examiners and applicants; not serious enough, in about half the cases, to preclude acceptance for insurance.

Heart Murmurs

There were 2,081 applicants with heart murmurs, either as solitary impairments or combined with other circulatory impairments. Of these, 1,912 were systolic in time; 169, diastolic. The following table depicts the nature of the murmurs, according to timing, location and transmission; with the rate of acceptance and the percentage of abnormal tests in each group.

Location of Murmurs	No. of Applicants	% Accepted	No. of C. R. Tests	% of Abnormal C. R. Tests
Systolic				
Basal, not transmitted	124	72.6	157	33.7
Apical, inconstant	68	72.0	73	31.5
Pulmonic area, not transmitted	329	67.1	406	36.9
Pulmonic area, transmitted downward	266	64.3	334	46.1
Apical, not transmitted	514	61.4	615	41.3
Apical, transmitted to left and upward	325	54.7	373	48.2
Apical, transmitted to left	186	52.7	210	48.5
Basal, transmitted downward	34	50.0	40	57.5
Aortic area, transmitted upward	66	31.8	66	66.6
Total, systolic murmurs	1912	59.9	2274	43.0
Diastolic				
Aortic area	109	10.0	116	92.8
Mitral area	60	18.3	63	74.6
Total, diastolic murmurs	169	13.0	179	79.9
All Murmurs	2081	56.1	2453	45.3

The rate of acceptance for all systolic murmurs was 59.9%; while that for diastolic murmurs was 13.0%. Of the declined applicants, 4.9% gave normal reactions, but were uninsurable for other reasons. The percentage of abnormal reactions for the systolic murmurs was 43.0; for the diastolic, 79.9.

It is notable that the percentage of abnormal reactions is lowest for those murmurs which are generally conceded to be of the lesser significance; systolic, localized at the apex or base, 33.7% to 41.3%. This percentage increases directly in proportion to the increasing severity of the type of murmur; transmitted apical and basal systolic murmurs, 48.2% to 57.5%; aortic systolic murmurs, transmitted upward, 66.6%; mitral diastolic, 74.6%; aortic diastolic, 92.8%.

This tendency will be noted later while discussing the variation of reactions with apical systolic murmurs occurring as solitary impairments, and in com-

bination with other circulatory impairments of varying degrees of severity. It is a fact which increases our confidence in the test; in the dependability of its indications as to the integrity of the circulation.

Systolic Murmurs

Considering first the systolic murmurs, the following table gives an analysis of five groups, comprising 1,620 of the 1,912 murmurs, indicating the percentage accepted when found as solitary impairments; in conjunction with hypertrophy, hypertension, or both; in conjunction with other circulatory impairments; with the total acceptance rate for each group:

Location of Murmur	As a Solitary Impairment. Accepted	With Hypertension, Hypertrophy, or Both. Accepted	With Other Impairments. Accepted	Total
Apical, not transmitted	73.2%	44.9%	46.0%	61.4%
Pulmonic, not transmitted	78.2%	48.2%	67.3%	67.1%
Pulmonic, transmitted downward	67.1%	43.2%	50.0%	64.3%
Apical, transmitted upward and to left	73.3%	36.7%	56.4%	54.7%
Apical, transmitted left	71.0%	36.0%	70.0%	52.7%

It is apparent that these murmurs, when occurring as solitary impairments, have been accepted with about equal freedom, at a rate of a little more than 70%. However, when combined with hypertrophy and hypertension, the rate of acceptance has dropped sharply, progressively; in direct proportion to the generally assumed severity of the murmur. When combined with the other circulatory impairments, this relationship is not apparent, though the rate of acceptance is generally lower.

Expressing it differently, we are receiving normal

reactions at about an equal rate in these five groups, when the murmur is the only impairment. In the presence of hypertrophy and hypertension, however, the normal reactions are not only notably decreased, but tend to decrease more in the apical than the basal murmurs; and more in the transmitted than in the localized murmurs.

This relationship is more apparent when these groups are subdivided in greater detail, with respect to the accompanying impairments. This is illustrated by the following analysis of one type of murmur. The percentage of abnormal reactions, in general, increases progressively in the presence of the more severe impairments, attaining its highest level when these impairments are combined. Conversely, the rate of acceptance decreases:

ANALYSIS OF SYSTOLIC MURMURS

LOCALIZED AT APEX

WITH ADDITIONAL IMPAIRMENTS

Nature of Additional Impairments	No. of Applicants	% Accepted	% of Abnormal Cardio-Respiratory Tests
Without other impairments	269	73.2	26.5
Goitre	12	83.3	21.4
Goitre, Hypertension	5	60.0	42.8
Tachycardia	30	60.0	42.9
Hypertrophy	38	55.3	49.9
Hypertension	68	54.4	50.7
Hypertension, Tachycardia	27	44.4	50.0
Intermittent Pulse	18	44.4	68.0
Tachycardia, Goitre	3	33.3	66.6
Hypertrophy, Tachycardia	7	28.5	55.5
Hypertension, Hypertrophy, Tachycardia	7	28.5	72.7
Hypertension, Hypertrophy	24	16.6	85.5
Hypertension, Intermittent Pulse	6	16.6	87.5
Total	514	61.4	41.3

Analysis of Insurance Issued: All Systolic Heart Murmurs

In order to show just how we have treated these risks, the following analysis is presented.

A total of 1,258 policies was issued, to the amount of $9,609,319. This is 50% of the entire amount issued to the 3,500 cases. The average policy was $7,639; $1,342 less than the average for the 3,500 cases. The policies were distributed as follows:

	% by Amount	% by Number	Average Amount of Policy
Ordinary Life	40.9	28.5	$10,942
Limited Payment Life	8.9	13.1	5,174
Modified Life	3.7	4.5	6,248
Endowment, 20 years and less	26.2	31.2	6,434
Endowment, over 20 years	5.6	8.9	4,766
Term, Five Year	14.7	13.7	8,195

It is obvious that the Ordinary and Limited Payment Life forms, the short Endowment and the non-renewable, non-convertible Term were the favorites.

The relative proportions of these forms varied considerably in accordance with the nature of the complicating circulatory impairments. The next table shows this. It is an analysis of the policies issued to systolic murmurs occurring as solitary impairments; in conjunction with hypertrophy, hypertension or both; in conjunction with other circulatory impairments.

	As a Solitary Impairment	In Conjunction With Hypertension and Hypertrophy	In Conjunction With Other Circulatory Impairments
Ordinary Life	32.3%	23.5%	22.9%
Limited Payment Life	14.9%	9.2%	14.3%
Modified Life	5.4%	3.1%	3.4%
Endowment, 20 yrs. and less	26.2%	39.3%	36.0%
Endowment, over 20 yrs.	9.9%	7.2%	8.0%
Term, Five-year	11.2%	17.7%	15.4%
All Policies	58.3%	27.7%	13.9%

It appears that over half the policies, 58.3%, were issued in the case of those murmurs which were not complicated by other circulatory impairments. In these, moreover, the Life forms amounted to 52.6%; the Endowments and Term, to 47.3%. In the presence of hypertension and hypertrophy, however, the Life forms were given less freely, 35.8%; the Endowments and Term predominating, 64.2%. This was also true, though not to the same extent, when other circulatory impairments were present.

This analysis is generally true for all the systolic murmurs, with the sole exception of the aortic murmurs. As already shown, the percentage of abnormal tests was high for these, 66.6%; and the rate of acceptance low, 31.8%. Those accepted were limited much more sharply than in the case of the other systolic murmurs. Policies on the Life forms amounted, by number, to 12%; Endowments, 72%; Term, 16%.

Diastolic Murmurs

There were 169 of these; aortic area, 109; mitral, 60. They were accepted at the rate of 13.0%; aortic, 10.0%; mitral, 18.3%. Twenty-two policies were issued, for a total amount of $124,595. This represents 0.64% of the total amount for the 3,500 cases; or

1.28% of the total amount issued to all heart murmurs. The variety of policies is shown in the next table:

ANALYSIS OF POLICIES ISSUED TO APPLICANTS WITH DIASTOLIC MURMURS

Plan	No. of Policies	Amount
Endowment 10	3	$ 7,000
Endowment 15	2	7,705
Endowment 20, Income to Insured only	2	29,685
Endowment 20	7	28,205
Endowment 39	1	2,000
Ordinary Life	1	3,000
Ordinary Life, Cash Value 14 yrs.	1	10,000
5 Yr. Term, Non-renewable Non-convertible	4	36,000
20 Payment Life	1	1,000
Total	22	$124,595

Hypertension

The standard for hypertension has been set arbitrarily; for systolic pressures, 15 mm. in excess of the average for the age; for the diastolic, 10 mm. in excess; adopting for the average pressures Table 3 of the 1925 report on blood pressure, by the joint Medico-Actuarial Committee.

The percentage of abnormal tests was considerably higher than in the case of any of the other circulatory impairments, excepting the diastolic and aortic systolic murmurs. The rate of acceptance, always low, varied

according to the nature of the accompanying impairments. When the hypertension was the sole impairment, it was 44.4%; when the chief impairment, 35.6%; associated with heart murmurs, 37.7%; in all cases with hypertension (970), 36.9%.

As the main interest lies in the more advanced hypertensions, two tables are inserted, dealing with the risks we have accepted who had systolic pressures of 150 mm. or more; or diastolic pressures of 100 mm. or more. There were 113 of these. Twenty-one presented both advanced systolic and diastolic pressures. Over 80% were under 55 years in age; systolic, 82%; diastolic, 85%. About 39% were in the 45-54 year group. About 60% of the policies were short Endowments and 5 Year Terms, non-renewable and non-convertible; about 40% were on the Life plans.

ANALYSIS OF BLOOD PRESSURE OF 113 ACCEPTED RISKS WITH SYSTOLIC PRESSURE OF 150 MM. OR OVER; WITH DIASTOLIC PRESSURE OF 100 MM. OR OVER; BY AGE GROUPS.

	25-34	35-44	45-54	55+	Total
SYSTOLIC					
150 mm.	10	10	6	3	29
151-155 mm.	5	13	17	7	42
156-160 mm.	2	1	12	4	19
161-165 mm.	0	1	4	1 (168)	6
166-172 mm.	1 (166)	0	1 (172)	3 (170) (172)	5
Total	18	25	40	18	101
DIASTOLIC					
100 mm.	3	2	3	1	9
101-105 mm.	3	5	8	3	19
106-110 mm.	0	2	1	1	4
111-112 mm.	0	1 (112)	0	0	1
Total	6	10	12	5	33

ANALYSIS OF POLICIES ISSUED TO 113 APPLICANTS WITH SYSTOLIC PRESSURE OF 150 MM. OR OVER, AND WITH DIASTOLIC PRESSURE OF 100 MM. OR OVER BY AGE GROUPS.

Age Group	Ordinary Life	Endowments 20 yrs. & less	5 Yr. Term Non-renewable Non-convertible	Limited Payment & Modified Life	Total Policies	Amounts
25-34	5 pol. $42,000	6 pol. $18,500	8 pol. $75,500	0 0	19	$137,000
35-44	7 pol. $57,000	16 pol. $139,000	5 pol. $60,000	5 pol. $27,000	33	$283,000
45-54	10 pol. $46,500	19 pol. $184,500	9 pol. $62,500	5 pol. $51,000	43	$344,000
55+	12 pol. $236,000	3 pol. $50,000	3 pol. $32,000	1 pol. $2,000	19	$320,000
Totals	34 pol. 29.8% $381,000	44 pol. 38.5% $392,000	25 pol. 21.9% $231,000	11 pol. 9.9% $80,000	114	$1,084,000 = 5.65% of total insurance issued. ($19,191,724)

Goitre

There were 297 cases presenting goitre. With but few exceptions there were no signs of toxicity. The reactions to the test were, on the whole, unusually favorable. The rate of acceptance was high; for all goitres, 69.3%; for goitres occurring as solitary impairments, 73.7%; associated with heart murmurs, 66.1%; with other circulatory impairments, 64.0%. A total amount of $1,270,955 was issued, with an average policy of $6,484. More Endowment and Term plans were issued than Life; 55.5% to 44.5%.

Irregular Pulse

There were 263 cases which showed an irregular pulse; as a solitary impairment in 107; associated

with other impairments, 156. With but few exceptions, this irregularity was due apparently to extra-systole.

There were a few cases with an absolute irregularity, with variation of the rhythm and force of the heart contractions. We have found that it is practically impossible to apply a satisfactory test in such cases, because of the difficulty of following the rapid variation of systolic pressure in successive pulsations. Needless to say, we have insured none of these.

The rate of acceptance for all cases was 58.0%; as a solitary impairment, 84.1%; when considered the chief impairment, 71.7%; with heart murmurs, 44.5%; with hypertrophy, 28.5%. The liberal policy forms have predominated; Life forms, 62.9%; Endowment and Term, 37.0%.

Tachycardia

All pulse rates in excess of 90 per minute have been included in this group. There were 385 cases; in only 31 of which the tachycardia was the sole impairment. The rate of acceptance in all cases was 46.7%; as a sole impairment, 93.5%; as the chief impairment, 65.7%; associated with heart murmurs, hypertension, hypertrophy and irregularity, 42.5%. The Endowment and Term plans predominated over the Life; 53.2% to 46.7%.

Hypotension

This group includes those cases with a systolic pressure of less than 100 mm. The general rate of acceptance was 68.9%; as a solitary impairment, 84.6%; associated with the more severe circulatory impairments, 47.3%. Policies on Life plans amounted to 66.6%; Endowment and Term plans, 33.3%.

Hypertrophy

There were 472 cases which showed apparent hypertrophy by the ordinary clinical methods of examination. The rate of acceptance in all cases was 32.2%; as a solitary impairment, 54.2%; with systolic heart murmurs only, 45.3%; with systolic murmurs and other circulatory impairments, 20.9%; with diastolic murmurs, 13.0%. The Endowment and non-renewable, non-convertible Term plans far exceeded the Life plans; 70% to 30%.

Overweight

There were 205 cases in which the weight was 20% or more in excess of the average, by the Medico-Actuarial Table. Of these, 113 were accepted, 55.1%. 116 policies were issued, distributed as follows: Ordinary Life, 24.1%; Limited Payment Life, 12%; Modified Life, 6%; Endowment, 20 years and less, 41.4%; Endowment, for more than 20 years, 5.2%; 5-Year Term, 11.2%. The Endowment and short Term plans predominated over the Life; 57.8% to 42.1%.

Analysis of Deaths

In this group are included all the accepted risks who have died. An attempt was made to investigate the condition of health of the 1,478 declined cases. We were able to trace about 63% of them, and are thus aware of some of the deaths among the declined cases. The following tables indicate the reason for giving the test, the duration of life afterward, the cause of death and the nature of the reaction.

Deaths Among Accepted Risks

	Age	Reason for Test	Duration of Life Afterward	Cause of Death	Nature of Reaction
1.	42	Systolic murmur at apex	6 mos.	Railroad accident	Normal
2.	25	Do., transmitted upward	11 mos.	Typhoid	Normal
3.	26	Do.,	9 mos.	Cerebral Thrombosis	High Normal
4.	51	Do., transmitted to axilla	1 mo.	Myocarditis	Abnormal
5.	43	Do., slight hypertrophy	21 mos.	Heart failure	Abnormal
6.	47	Pulmonic, transmitted downward	33 mos.	Heart disease	High Normal
7.	47	Do., pulmonic, slight hypertrophy	13 mos.	Suicide	Normal
8.	32	Diastolic murmurs, aortic & mitral	17 mos.	Heart failure Psycho-neurosis	Normal
9.	48	Irregular pulse	2 mos.	Heart failure	Normal
10.	25	Do.,	18 mos.	Suicide	Normal
11.	62	Auricular fibrillation	5 mos.	Angina pectoris	Abnormal
12.	54	Overweight, 23%	3 mos.	Cancer rectum	Normal
13.	40	History mitral regurgitation	16 mos.	Peritonitis	Borderline
14.	44	History of murmur & hypertension	19 mos.	Nephritis	Normal
15.	51	History of hypertension	50 mos.	Hypertrophy Congestion lungs	Borderline

There were fifteen deaths among the accepted risks. Nine of these, 60%, were of circulatory origin (one due to nephritis); two were due to suicide; one to accident; one to cancer; one to typhoid; one to peritonitis.

It will be noted that three of them gave abnormal reactions. One of these (11) was very poor; so much so, that the risk would not have been accepted, had he not been one of a considerable group of business associates, otherwise good. The second (5) gave a marked hyperactive reaction and, in my opinion, should not have been accepted. The third (4) had been insured with us for ten years, and allowed his policy to lapse. On examination for reinstatement, a heart murmur was detected and the test applied. The reaction was decidedly hypoactive and would have

led to outright rejection had there been an application for new insurance. However, consistent with our liberality in such cases, the policy was reinstated.

Deaths Among Declined Risks

	Age	Reason for Test	Duration of Life Afterward	Cause of Death	Nature of Reaction
1.	61	Systolic murmur at apex, localized	13 mos.	Unknown	Abnormal
2.	54	Do., with bradycardia (P. R. 44)	Unknown	"	Abnormal
3.	64	Do., transmitted, upward	37 mos.	Angina Pectoris	Abnormal
4.	40	Do., transmitted to left, slight hypertrophy, extra-systoles	7 mos.	Heart Disease	Abnormal
5.	40	Do., transmitted upward, extra-systoles	40 mos.	Heart Failure	Abnormal
6.	41	Diastolic murmur, mitral	Unknown	Unknown	High Normal
7.	37	Diastolic, aortic & mitral	26 mos.	Heart Failure	Abnormal
8.	28	Systolic pulmonic	Unknown	Tuberculosis	Abnormal
9.	55	Systolic murmur, pulmonic, extra-systole	Unknown	Unknown	High Normal
10.	43	Do., extra-systole	24 mos.	Heart Failure	Abnormal
11.	64	Do., basal, transmitted downward, slight hypertrophy	8 mos.	Cancer	Abnormal
12.	60	Hypertension, hypertrophy	16 mos.	Heart Failure	Abnormal
13.	61	Do.,	28 mos.	Pneumonia	Abnormal
14.	56	Do.,	3 mos.	Cerebral thrombosis	Abnormal
15.	61	Do.,	20 mos.	Pernicious Anaemia	Abnormal
16.	57	Do.,	12 mos.	Angina Pectoris	Abnormal
17.	50	Slight hypertrophy, anginoid attacks	48 mos.	Heart Failure	Abnormal
18.	54	Extra-systoles	7 mos.	Endocarditis	Abnormal
19.	57	Do., with systolic murmur aortic area	19 mos.	Heart Disease	Abnormal
20.	63	History suspicious of lues	Unknown	Unknown	Low Normal

We have learned of 20 deaths among the declined cases. In 5 of them, the date and cause of death were not determined. Eleven of them were of circulatory origin, 55%. In all cases of known death from circulatory failure, the reaction to the test was abnormal.

Mortality Experience

No attempt has been made to determine the mortality for this group of 3,500 cases. As has been our custom previously, Mr. Dow, our Actuary, has made the following analysis of mortality experience for all insured risks to whom the test was applied, up to September, 1927:

"This investigation included 3,625 policies with insurance of $26,480,478. Excluding cancelled, there remained 3,060 policies for insurance of $22,625,038. The investigation was closed in September, 1927, with a maximum duration of six years for any insurance.

"The percentage of deaths by the American Experience Table was 25.59 of the expected. A corresponding percentage by the American Men Select Table was 48.20. There were death claims on 17 policies for a total of $112,705 of insurance. Eight of the policies were less than one year old at time of death."

It is of interest to note that the mortality up to the fall of 1925 was 33.3% of the expected by the American Men Select Table; while in the fall of 1926, it was 13.12% by the American Experience Table and 25.91% by the American Men Select Table.

Summary

1. The Cardio-Respiratory Test has been used by us intensively for five years as an aid in the selection of risks with circulatory impairments, apparent or suspected, or with past histories of serious disease.

2. It has been introduced to 69 of our General and District Agencies, covering the entire field of operation of our company.

3. Instruction in its application has been given to 110 of our examiners. Of these, 84.5% have learned the technique to our satisfaction; 15.5% have failed.

4. The only important change in technique has been an alteration of Step Five, making it identical with Steps Six, Seven and Eight.

5. There has been but little change in our opinion as to the normal reaction.

6. The abnormal reactions comprise the hypoactive, hyperactive, irritable and hypertensive. Each has its peculiar characteristics. Abnormal reactions may conform to one of these types, or may embody the characteristics of two or more.

7. A general analysis is given of 3,500 applicants, examined during the four-year period from the fall of 1922 to the fall of 1926. Of these applicants, 57.7% were accepted.

8. Insurance was issued on 2,137 policies, to the amount of $19,191,724; with an average amount per policy of $8,981. The distribution by policy forms and ten-year age groups is indicated.

9. An analysis of the unsatisfactory reactions is given to illustrate the degree of difficulty we have experienced in the application of the test.

10. The proportions of the chief impairments for which the test was applied are indicated. Heart murmurs amounted to over half of the impairments.

11. Each of the chief impairments is treated separately, emphasizing the variation in the rate of acceptance and in the forms of policies issued, accord-

ing to the severity of the impairment; to its existence as a sole impairment or in association with other circulatory impairments.

12. The deaths are analyzed; both for the accepted risks and for such of the declined as could be traced.

13. Mortality experience is given for all the risks insured as a result of the use of the Cardio-Respiratory Test, up to September, 1927.

Conclusion

I appreciate that considerable interest exists in life insurance medical circles in our method of selection of risks with circulatory impairments. I believe there is doubt, and perhaps even misinformation, as to our procedure.

With this in mind, I have tried to anticipate the practical questions which may arise; to give the information which will answer them. I have purposely confined myself to an exposition of the facts. I shall conclude with an expression of my opinion as to the merits of the Cardio-Respiratory Test.

Experience leaves me in no doubt as to the practicability of the test. It has been introduced, without any particular difficulty, throughout our entire company organization. Of the examiners chosen to apply it, 85% have acquired the technique with reasonable facility. Of the reactions submitted, only 5% have been unsatisfactory. The additional expense involved is not considered to be prohibitive. When the proper time arrives, I see no reason why the test should not be introduced more extensively, to the smaller field units of our organization; having in mind always

that basic requirement, on the part of the examiner, of skill in the observation and description of clinical signs. In short, I believe the test to be entirely practicable.

It provides an accurate measuring rod of the degree of circulatory efficiency existing at the time of examination. This belief results in part from observation of individuals known to be physically impaired; in whom an obvious improvement in health has been checked by an improved reaction to the test. Furthermore, it is fortified by the fact, demonstrated in the foregoing analysis, that as the degree of circulatory impairment becomes greater, the proportion of abnormal reactions to the test directly increases.

A frankly abnormal reaction calls for outright rejection, or postponement, of the risk. Reactions which present minor abnormalities may permit acceptance, with modification of form or amount of policy.

In estimating the insurability of any risk, in the presence of a normal reaction, due attention must be paid to the history, and to the character of the abnormal physical signs. The normality of the reaction affords no guarantee as to longevity. It indicates merely that at the time of examination the circulation is efficient; in no danger of immediate collapse; not appreciably affected. With this very advantageous basis, weighing the abnormal signs and relative history, an estimate of insurability may be made, and the appropriate form and amount decided upon.

In other words, even in the presence of a normal reaction, it is frequently necessary to modify the form and amount of insurance, on account of the

character of the physical signs and history. It may be necessary to decline the risk outright; as, for instance, in the case of a history of probable angina pectoris; or in certain cases presenting signs of severe aortic or mitral valvular disease. In a comparatively small percentage of these, 10-20%, normal reactions will be obtained. However, in the present state of our knowledge, I consider that the probabilities as to their longevity are too uncertain to permit consideration for insurance.

During these last five years, the test has been applied to 5,231 applicants; to 64.42% of whom some form of standard insurance has been offered; the vast majority of whom we should not have considered at all, previously. To the present, the mortality has been favorable, and there has been no reason for dissatisfaction with the Cardio-Respiratory Test and the method of selection which we have builded upon it. This method we propose to continue.

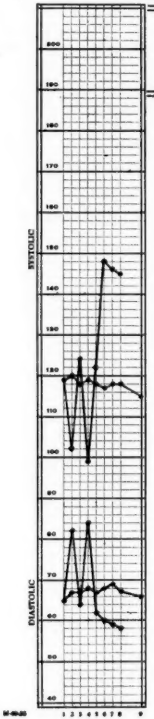
Dr. Beckett—I will ask Dr. Amiral, also of the New England Mutual, to present his paper "The Reaction of the Diastolic Pressure to the Cardio-Respiratory Test."

1

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name_____ Date _____



M-60-35

Blood Pressure and Pulse:—

Before Test:	*After Test:*
Systolic___	Systolic___
Diastolic___	Diastolic___
Pulse Rate___	Pulse Rate___

Vital Capacity—

Capacity Blown:—(1) ____ cu. in.
(2) ____ cu. in.
(3) ____ cu. in.

EXAMINER'S REPORT

AGENCY_____

Composite of twenty cases.

Chart I

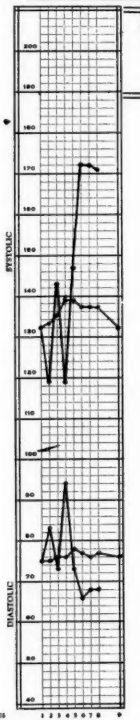
_____
Medical Examiner

2

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name_____ Date _____



M-60-35

Blood Pressure and Pulse:—

Before Test:	*After Test:*
Systolic___	Systolic___
Diastolic___	Diastolic___
Pulse Rate___	Pulse Rate___

Vital Capacity—

Capacity Blown:—(1) ____ cu. in.
(2) ____ cu. in.
(3) ____ cu. in.

EXAMINER'S REPORT

AGENCY_____

Composite of forty-two cases.

Chart II

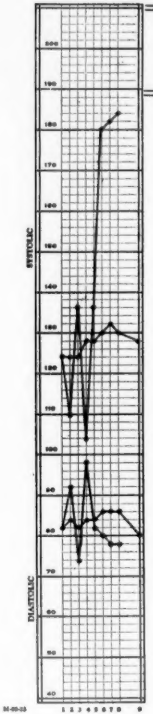
_____
Medical Examiner

3

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name _____ Date _____



M-60-25

Blood Pressure and Pulse:—

Before Test:		*After Test:*	
Systolic...	124	Systolic...	128
Diastolic...	82	Diastolic...	80
Pulse Rate...	84	Pulse Rate...	69

Vital Capacity— 275 cu. in.

Capacity Blown:—(1) 255 cu. in.
(2) 255 cu. in.
(3) 275 cu. in.

EXAMINER'S REPORT

AGENCY _____

Ex-college student, track athlete, age 26.
6 ft. 2 in., weight 188.
Clinical findings; no hypertrophy, systolic murmur over precordia not transmitted.
Question of athletic heart.

Chart III

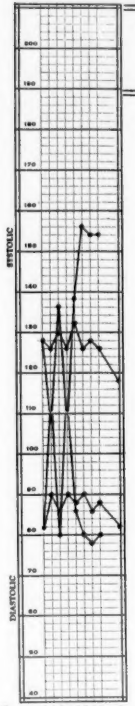
_____
Medical Examiner

4

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name _____ Date _____



M-60-25

Blood Pressure and Pulse:—

Before Test:		*After Test:*	
Systolic...	128	Systolic...	118
Diastolic...	82	Diastolic...	82
Pulse Rate...	58	Pulse Rate...	68

Vital Capacity— 305 cu. in.

Capacity Blown:—(1) 300 cu. in.
(2) 305 cu. in.
(3) 295 cu. in.

EXAMINER'S REPORT

AGENCY _____

Salesman and clerk, age 45.
6 ft. 3 in., 186 lbs.
History of temporary aphasia.
Short basal systolic murmur not transmitted, no hypertrophy.

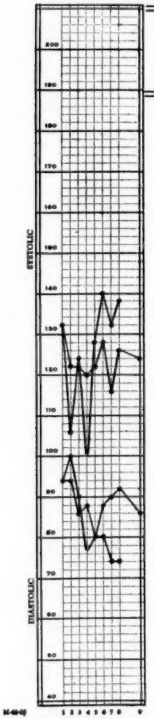
Chart IV

_____
Medical Examiner

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name _____ Date _____



Blood Pressure and Pulse:— Vital Capacity = 180 cu. in.

Before Test:	*After Test:*	Capacity Blown:—(1) 160 cu. in.
Systolic — 132	Systolic — 124	(2) 180 cu. in.
Diastolic — 94	Diastolic — 86	(3) 180 cu. in.
Pulse Rate — 78	Pulse Rate — 78	

EXAMINER'S REPORT

AGENCY _____

Sales manager, age 39.

5 ft. 9 in., weight 134 lbs.

Clinical findings; hypertrophy, systolic murmur transmitted to the axilla, question of thrill over the apex.

Diagnosis mitral regurgitation with probably mitral stenosis.

Chart V

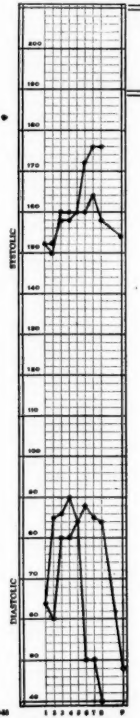
_____

Medical Examiner

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name _____ Date _____



Blood Pressure and Pulse:— Vital Capacity = 140 cu. in.

Before Test:	*After Test:*	Capacity Blown:—(1) 140 cu. in.
Systolic — 152	Systolic — 154	(2) 140 cu. in.
Diastolic — 64	Diastolic — 48	(3) 140 cu. in.
Pulse Rate — 100	Pulse Rate — 100	

EXAMINER'S REPORT

AGENCY _____

Bank clerk, age 25.

5 ft. 7 in. weight 126 lbs.

Systolic and diastolic murmurs, hypertrophy.

Diagnosis: Aortic regurgitation, mitral regurgitation, probable mitral stenosis.

Chart VI

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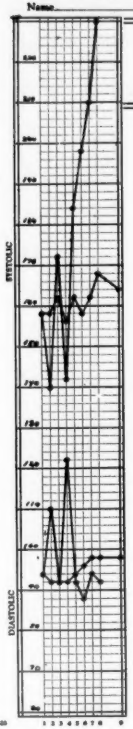
Medical Examiner

7

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name _____ Date _____



Blood Pressure and Pulse:—

Before Test:	After Test:	Vital Capacity— 170 cu. in.
Systolic— 158	Systolic— 164	Capacity Blown:—(1) 170 cu. in.
Diastolic— 94	Diastolic— 98	(2) 150 cu. in.
Pulse Rate— 64	Pulse Rate— 66	(3) 150 cu. in.

EXAMINER'S REPORT

AGENCY _____

Laborer in post office, age 47.

5 ft. 10 in., weight 140 lbs.

Systolic murmur over precordia transmitted to axilla. Brachial arteries thickened.

Chart VII

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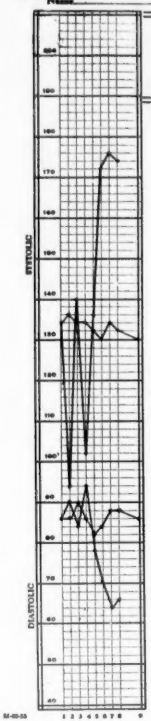
Medical Examiner

8

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name _____ Date _____



Blood Pressure and Pulse:—

Before Test:	After Test:	Vital Capacity— 465 cu. in.
Systolic— 134	Systolic— 130	Capacity Blown:—(1) 440 cu. in.
Diastolic— 86	Diastolic— 86	(2) 466 cu. in.
Pulse Rate— 80	Pulse Rate— 80	(3) 455 cu. in.

EXAMINER'S REPORT

AGENCY _____

House painter, age 40.

5 ft. 11 3/4 in., weight 200 lbs.

Past history of irregularity of heart action.

No abnormal clinical findings.

Chart VIII

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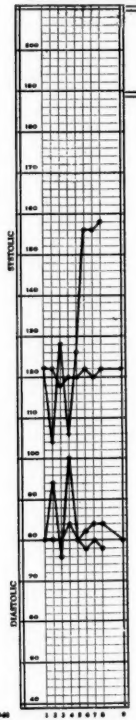
Medical Examiner

9

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name_____ Date_____



Blood Pressure and Pulse:—

Before Test:	*After Test:*
Systolic— 122	Systolic— 122
Diastolic— 80	Diastolic— 80
Pulse Rate— 84	Pulse Rate— 76

Vital Capacity— 340 cu. in.

Capacity Blown:—(1) 320 cu. in.
(2) 290 cu. in.
(3) 340 cu. in.

EXAMINER'S REPORT

AGENCY_____

Supt of soap factory, age 29.

6 ft. weight 246 lbs.

Past history of high blood pressure.

No abnormal clinical findings.

Chart IX

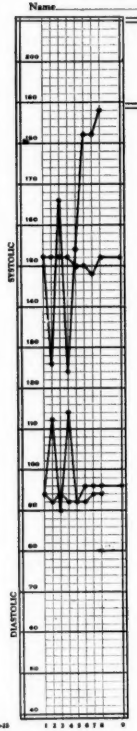
Medical Examiner

10

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name_____ Date_____



Blood Pressure and Pulse:—

Before Test:	*After Test:*
Systolic— 152	Systolic— 152
Diastolic— 94	Diastolic— 96
Pulse Rate— 88	Pulse Rate— 88

Vital Capacity— 180 cu. in.

Capacity Blown:—(1) 170 cu. in.
(2) 170 cu. in.
(3) 180 cu. in.

EXAMINER'S REPORT

AGENCY_____

Age 60, height 5 ft. 9 in., weight 150 lbs.

Clinical findings: First sound over apex muffled; systolic murmur over precordia not transmitted.

Chart X

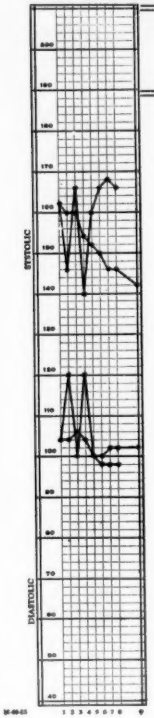
Medical Examiner

11

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name _____ Date _____



Blood Pressure and Pulse:— Vital Capacity = 80 cu. in.

Before Test:	*After Test:*	Capacity Blown:—(1) 80 cu. in.
Systolic... 162	Systolic... 142	(2) 80 cu. in.
Diastolic... 104	Diastolic... 102	(3) 80 cu. in.
Pulse Rate... 84	Pulse Rate... 76	

EXAMINER'S REPORT

AGENCY _____

Woman 47, no occupation.

5 ft. 4 3/4 in., weight 170 lbs.

No abnormal clinical findings other than over weight.

Chart XI

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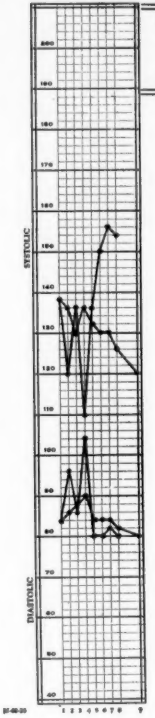
Medical Examiner

12

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name _____ Date _____



Blood Pressure and Pulse:— Vital Capacity = 200 cu. in.

Before Test:	*After Test:*	Capacity Blown:—(1) 180 cu. in.
Systolic... 138	Systolic... 120	(2) 200 cu. in.
Diastolic... 84	Diastolic... 80	(3) 200 cu. in.
Pulse Rate... 66	Pulse Rate... 76	

EXAMINER'S REPORT

AGENCY _____

Campaign director, age 28.

5 ft. 7 3/4 in., weight 246 lbs.

No abnormal clinical findings other than over weight.

Chart XIa

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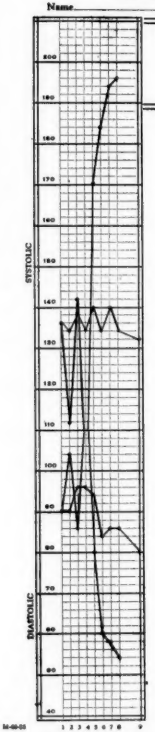
Medical Examiner

13

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name_____ Date_____



Blood Pressure and Pulse:—

Before Test:	*After Test:*
Systolic— 136	Systolic— 132
Diastolic— 90	Diastolic— 80
Pulse Rate— 68	Pulse Rate— 63

Vital Capacity— 250 cu. in.

Capacity Blown:—(1) 220 cu. in.
(2) 250 cu. in.
(3) 240 cu. in.
(4) 250

EXAMINER'S REPORT

AGENCY_____

Advertising agent, 35 years of age.

5 ft. 9 in., weight 223 lbs.

No hypertrophy, systolic murmur over precordia not transmitted, over weight.

Chart XIII

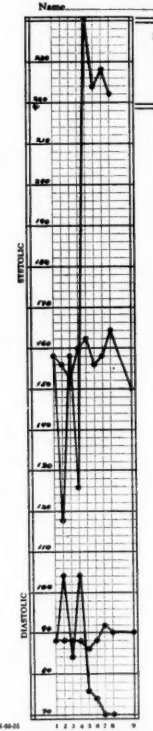
_____
Medical Examiner

14

CARDIO-RESPIRATORY TEST

New England Mutual Life Insurance Company, of Boston, Mass.

Name_____ Date_____



Blood Pressure and Pulse:—

Before Test:	*After Test:*
Systolic— 158	Systolic— 150
Diastolic— 88	Diastolic— 90
Pulse Rate— 92	Pulse Rate— 92

Vital Capacity— 290 cu. in.

Capacity Blown:—(1) 280 cu. in.
(2) 280 cu. in.
(3) 290 cu. in.
(4) 290

EXAMINER'S REPORT

AGENCY_____

Industrial engineer, age 31.

5 ft. 9½ in., weight 180 lbs.

Systolic murmur over precordia, definite.

hypertrophy of heart.

Chart XIV

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Medical Examiner

CHART XV

TYPES OF REACTIONS

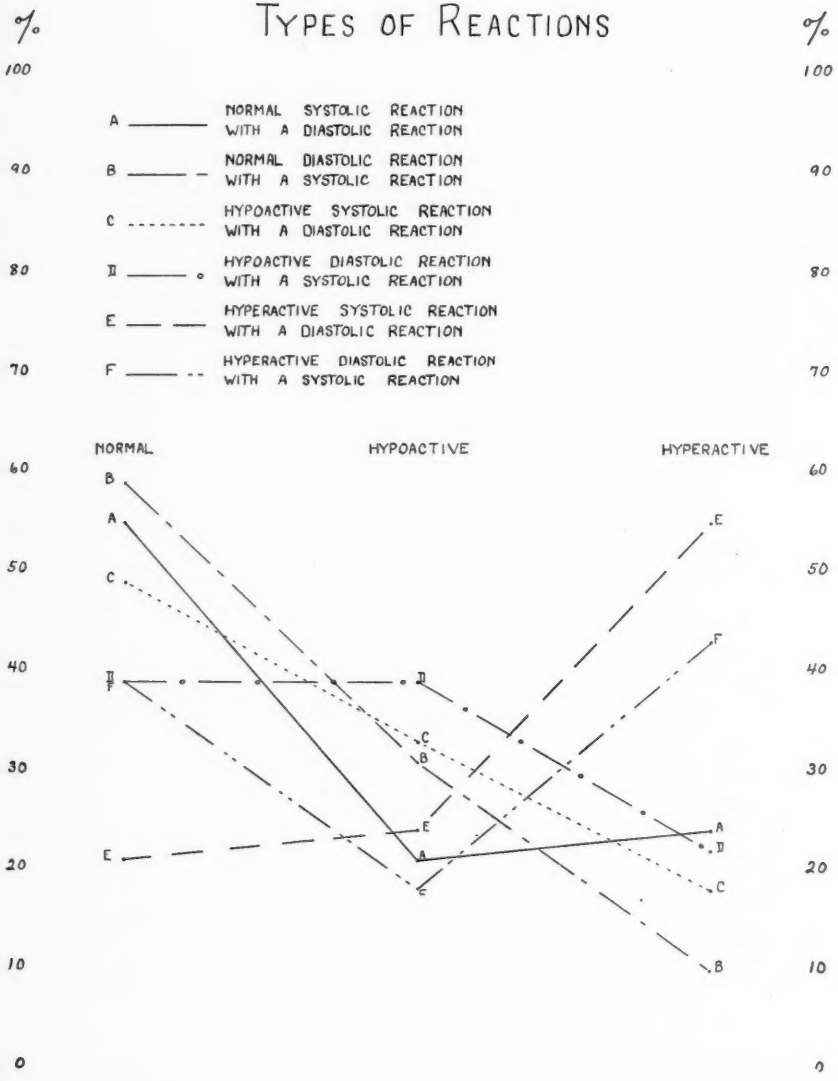


CHART XVI

ALL CASES - AGES

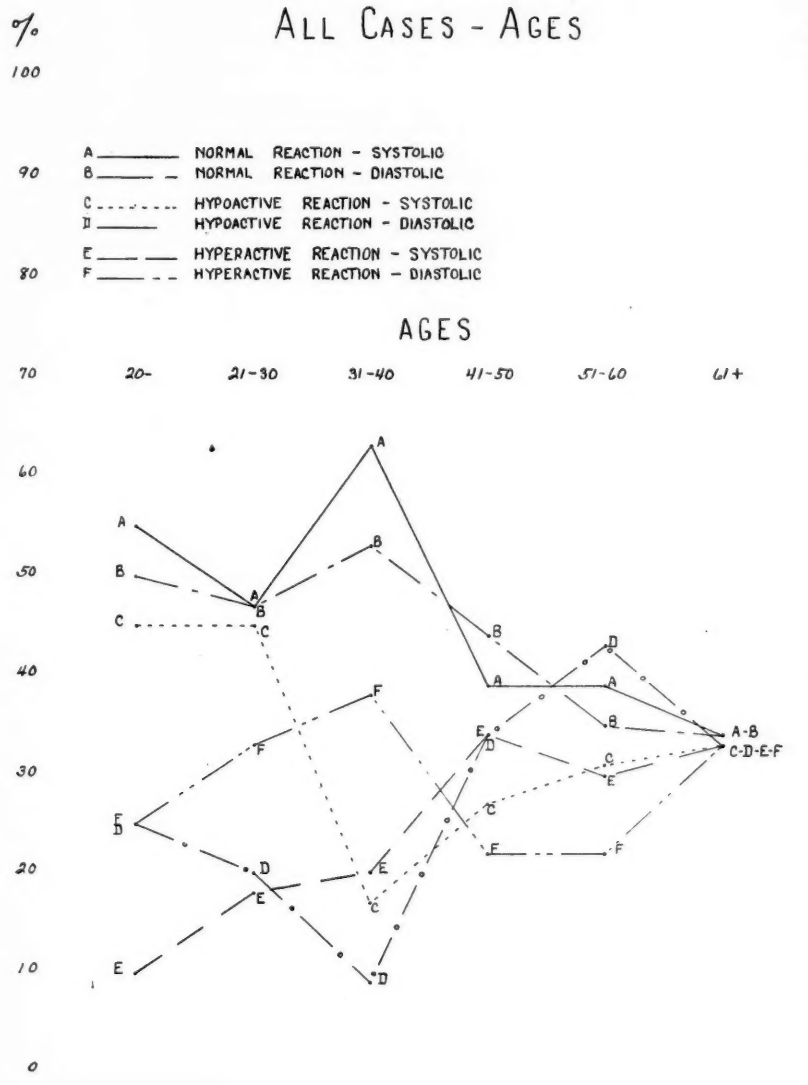


CHART XVII

ALL CASES - WEIGHTS

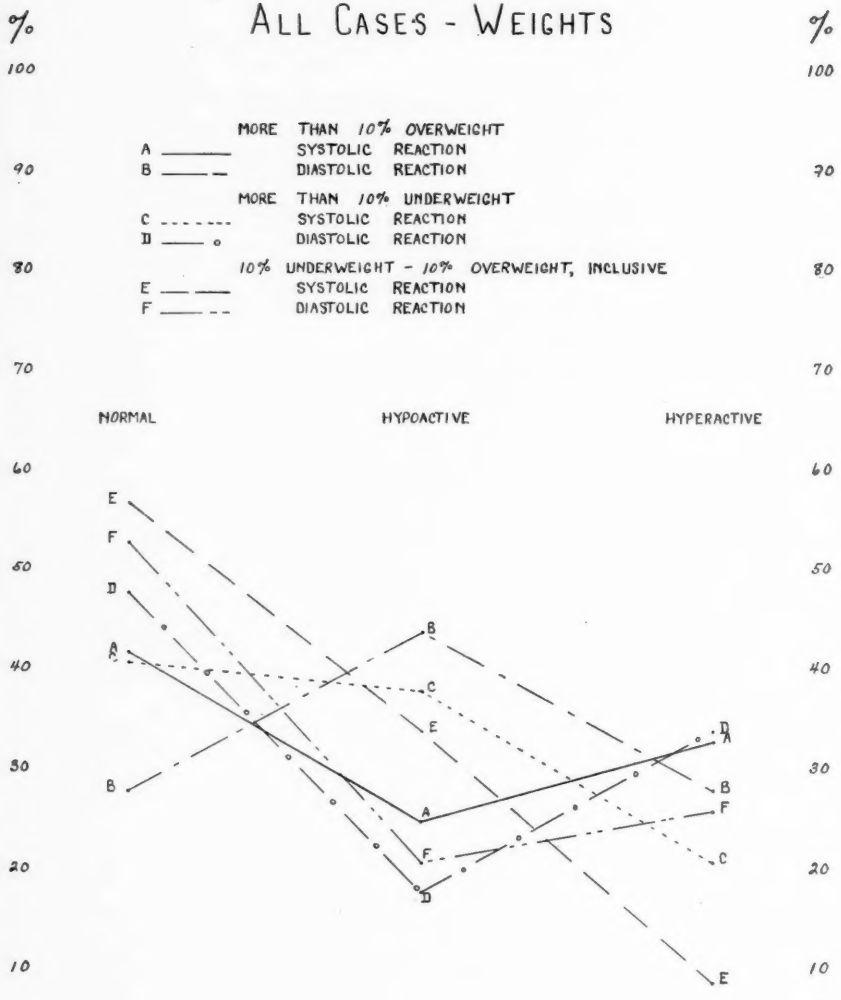


CHART XVIII

PULSE PRESSURE BEFORE TEST

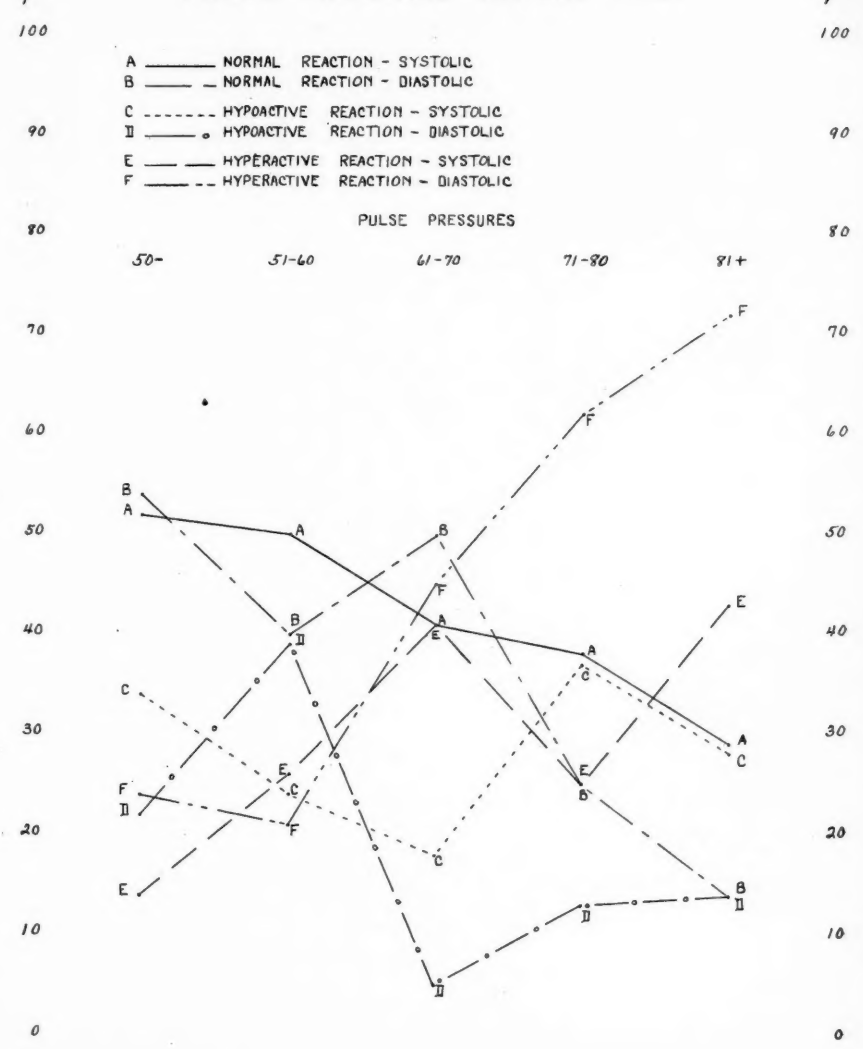


CHART XIX

PULSE PRESSURE CHANGES AS A RESULT OF THE CARDIO-RESPIRATORY TEST

PULSE PRESSURE - INCREASED MORE THAN 8 MM.
A ——— SYSTOLIC REACTION
B —— — DIASTOLIC REACTION

PULSE PRESSURE - DECREASED MORE THAN 8 MM.
C - - - - - - - SYSTOLIC REACTION
II —— o DIASTOLIC REACTION

PULSE PRESSURE - 8 MM UNDER - 8 MM OVER, INCLUSIVE
E — — SYSTOLIC REACTION
F —— - - DIASTOLIC REACTION

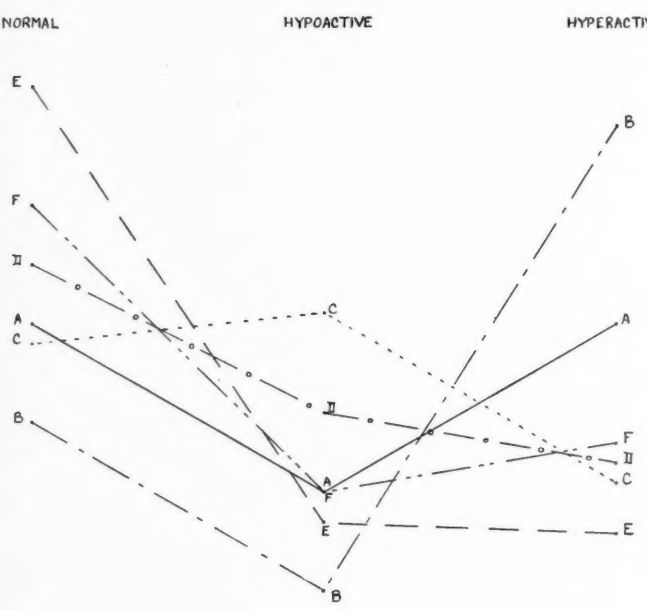
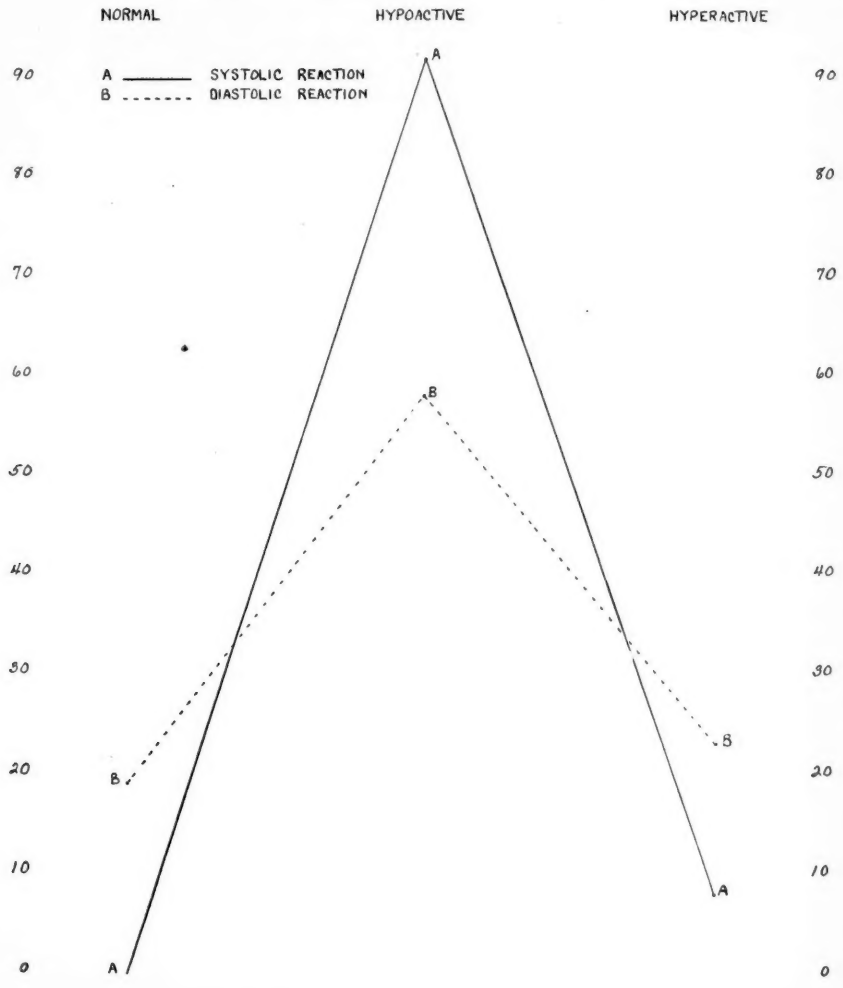


Chart XX

Cases Where Systolic Reaction Showed Evidence of Myocarditis



REACTION OF THE DIASTOLIC PRESSURE TO THE CARDIO-RESPIRATORY TEST

by Hiram H. Amiral, M. D.
Home Office Examiner, New England Mutual Life Insurance Co.

Thanks to Dr. Frost, the reaction of the systolic pressure to the cardio-respiratory test has passed beyond the experimental stage, and we now know that the test is of great value in determining cardio-vascular function. Although it must be apparent that the diastolic pressure also must vary under strain, very little work has been done on this subject.

During the past three or four years in connection with the routine application of the cardio-respiratory test, I have studied the reaction of the diastolic pressure in some detail. The preliminary work consisted in studying the reaction of normal persons in order to determine the changes in diastolic pressure from step to step, and to determine the characteristic points for plotting in order to make a readable curve which could be compared with the systolic curve. The results were briefly as follows:

In Steps two and four, with increased positive pressure in the chest, there was noticed an abrupt rise in the diastolic pressure, followed by an abrupt fall to a little below the base line, and a consequent return to the base line. The point of maximum rise seemed to be the characteristic point to be charted for these two steps.

In Step three, there was at first a slight rise in pressure followed by a noticeable fall below the base line. This, in turn, was followed by a gradual return to the base line. The point of minimum fall of pressure seemed to be characteristic of this step and was charted.

Steps five, six, seven and eight were identical. There was at first a sharp rise in the diastolic pressure, followed by a gradual fall to a degree several points below the base line, and then a gradual return to the base line. The minimum point reached by the diastolic pressure seemed to be characteristic of these steps and was charted.

These observations were made on twenty normal young adults, and the results compared with similar observations on the reaction of the systolic pressure. The result is shown in *Chart One.* It will be noted that the curve of the diastolic pressure varies inversely with that of the systolic pressure.

In order to check up on these findings, forty-two medical students were examined, using Dr. Frost's technique; Dr. Frost making observations on the systolic pressure on one arm, and the author making observations on the diastolic pressure on the other arm. The results are shown in *Chart Two,* and conform to the results found hitherto.

Following this preliminary study, when applicants were presented to the author for a cardio-respiratory test on account of some impairment, he noted the reaction of both systolic and diastolic pressures whenever possible. After some practice, it was not difficult to observe the variations of both pressures if the following technique was followed.

Steps two and four. The base lines of both systolic and diastolic pressure were taken. The applicant made the effort in the routine way, with resulting fall in systolic pressure. As the systolic pressure falls, the diastolic pressure rises simultaneously so that the pulse pressure is very small, and it is possible to note both systolic and diastolic pressures fairly accurately. Often the pulse pressure becomes zero as the two pressures merge, and while the actual point at which they merge is difficult to determine accurately, it can be approximated. In the cases where there is a very little change in either pressure, it is necessary to go through the step once for the diastolic, and once for the systolic pressure.

Steps three, five, six, seven and eight. In all of these steps it is possible to obtain the maximum point reached by the systolic pressure in the usual routine way, and the minimum point reached by the diastolic pressure, because the latter is found to lag ten to fifteen seconds behind the former. It seemed possible to observe both systolic and diastolic pressures with a fair amount of accuracy without varying the test, as described by Dr. Frost, only in that the intervals between steps are necessarily lengthened.

I now present a study of 185 cases in which the above technique is used, preceded by the following general statements.

These cases with very rare exceptions were all examined by me. The action on these cases, as regards issuance of policies, was by various Medical Directors at various times, and was based solely, so far as the cardio-respiratory test was concerned, on the reaction of the systolic pressure. The only consideration

given to the diastolic pressure was in the usual routine way, as to whether it was within normal limits, elevated or lowered, before or after the test, no attention being given to its reaction to the test. In this study, the interpretation of both systolic and diastolic curves were all made by me, and may have varied somewhat from interpretations made by others.

No attempt is made at this stage to classify according to impairments. At present, I have satisfied myself with comparing the reactions. It seemed convenient to divide the types of reactions into three classes. First, those that were within normal limits; second, those that were hypoactive; third, those that were hyperactive. This classification is used for both systolic and diastolic pressures.

Charts I to XIV, inclusive, show characteristic curves as classified above.

Charts I and II, as noted above, show typical normal systolic and diastolic reactions, the systolic reaction of Chart I being a somewhat low normal one.

Chart III is that of an ex-college student and track athlete, age 26. He had no hypertrophy. There was a short systolic murmur heard over the precordia but not transmitted. The systolic reaction is a mildly hyperactive one; the diastolic is within normal limits.

Chart IV shows a diastolic reaction within normal limits with a hypoactive systolic reaction. It is that of a salesman, age 43, who showed on examination a short basal systolic murmur. It will be noted that no definite point was plotted for Steps 2 and 4 for either systolic or diastolic pressure. It will be seen

in these two steps that the two pressures merged and while the definite point at which they merged could not be determined accurately, it was approximately in the neighborhood of 110.

Chart V shows abnormal systolic and diastolic reactions. The systolic reaction is definitely hypoactive with irregularly falling base line and markedly diminished response in the last three steps. The diastolic reaction is of the hyperactive type, with poor response in Step 4 and increased fall of pressure in the last three steps. This reaction is that of a sales-manager, age 39, 5 feet 9 inches tall, weighing 134 pounds. His heart showed hypertrophy with a systolic murmur transmitted to the axilla and a thrill palpable over the apex. The clinical diagnosis was mitral regurgitation with probable mitral stenosis.

Chart VI shows abnormal systolic and diastolic reactions, the systolic reaction being hypoactive and the diastolic hyperactive. The applicant was a bank clerk, age 25, 5 feet 7 inches tall, weighing 126 pounds. His heart showed hypertrophy, systolic and diastolic murmurs. The clinical diagnosis was aortic regurgitation, mitral regurgitation and, probably, mitral stenosis. In the systolic reaction, note absence of the fall of pressure in Steps 2 and 4, irregular base line and the diminishing response in the last three steps. In the diastolic reaction, there was a diminished rise in Steps 2 and 4 with increased response in the last three steps along with a sharp initial rise in the base line and a sharp terminal fall.

Chart VII shows a hyperactive systolic with a hypoactive diastolic reaction. The applicant was a laborer

in a post-office, age 47, 5 feet 10 inches tall, weighing 140 pounds. He showed a systolic murmur transmitted to the axilla and definitely thickened brachial arteries as well as increased blood pressure. Note the rising base line of the systolic pressure; the increased response in the last three steps and the diminished response in the last four steps of the diastolic reaction.

Chart VIII shows a normal systolic reaction with a definitely hyperactive diastolic reaction. The applicant was a house painter, age 40, 6 feet tall, weighing 200 pounds. He gave a past history of irregular heart. No abnormal findings were noted at the time of the examination. Note the diminished rise of the diastolic pressure in Steps 2 and 4 and the increased fall of pressure in the last three steps.

Charts IX and X both show normal systolic reactions with definitely hypoactive diastolic reactions. The base lines in Chart IX are at normal levels; those of Chart X, at higher levels. They are shown together to show similar reactions in normal and increased blood pressures.

Charts XI and XII both show hypoactive systolic and diastolic reactions. They are shown together to illustrate similar reactions in normal and increased blood pressures. Note in both charts, the rapidly falling systolic base line with a diminished response of the diastolic pressures in the last four steps.

Charts XIII and XIV illustrate hyperactive systolic and diastolic reactions. In Chart XIII, the systolic and diastolic pressures are within normal limits. In Chart XIV, they are elevated. They are

shown together to show similar reactions with normal and increased blood pressures.

It is apparent from the foregoing charts that, given a certain type of systolic reaction, it does not necessarily follow that the same type of diastolic reaction will be obtained and vice versa.

In Chart XV we have a graphic representation of the types of systolic reaction obtained with various types of diastolic reaction and vice versa.

Line A represents percentages of the various types of diastolic reaction which were obtained in cases with a normal systolic reaction. Of the 185 cases examined, 89 showed normal systolic reactions. If we follow Line A, it will be seen that more than half of these showed normal diastolic reactions, the remainder being equally divided between hypoactive and hyperactive diastolic reactions.

Eighty-five cases showed normal diastolic reactions. *Line B* represents the percentages and types of systolic reactions obtained in these cases. It will be seen that nearly 60% showed normal systolic reactions; about 30% were hypoactive and only 10% were hyperactive. *Lines A and B,* therefore, would appear to show that with a normal systolic reaction, in most cases a normal diastolic reaction is obtained and vice versa.

Fifty-four cases showed hypoactive systolic reactions, and are represented by *Line C.* This line demonstrates that nearly half showed normal diastolic reactions; about one-third showed hypoactive diastolic reactions and 18% were hyperactive.

Forty-six cases gave hypoactive diastolic reactions, and are represented by *Line D.* This line demon-

strates that 39% showed normal systolic reactions. An equal number showed hypoactive reactions whereas only 22% showed hyperactive reactions.

Forty-two cases gave hyperactive systolic reactions, and are represented by *Line E*. This line shows that well over 50% of these gave a hyperactive diastolic reaction, the remainder being nearly equally divided between normal and hypoactive reactions.

Fifty-four cases gave hyperactive diastolic reactions, and are represented by *Line F*. This line shows that well over 40% gave hyperactive systolic reactions, nearly as many were normal and a small percentage were hypoactive.

Again it will be seen that in any given case the diastolic reaction is not necessarily the same as that of the systolic and vice versa. There is, however, a definite tendency to agreement. This tendency is less in those showing hypoactive reactions.

Classification as to Age

We now have *Chart XVI* which represents the classification according to age and percentages of various types of reaction.

Line A represents normal systolic reactions. It will be seen that the ages up to 40 show the highest percentage, the best ages being 31 to 40, with a gradual decline in the higher ages.

Line B, representing the normal diastolic reactions, follows, in general, the tendency of Line A.

Lines C, D, E and F represent abnormal reactions. *Line C,* representing hypoactive systolic reaction,

shows a relatively high percentage up to age 30 with a marked fall between ages 31 to 40 and a consequent gradual rise in the older ages. *Line D,* representing hypoactive diastolic reactions, shows a small percentage in the younger ages, being the least at ages 31 to 40 and followed by a sharp rise in the older ages. *Line E,* representing hyperactive systolic reactions shows a small percentage in the younger ages with a gradual and constant increase in the older ages. *Line F* represents hyperactive diastolic reactions. This shows an increase up to ages 31 to 40; then a decrease in the older ages with a slight increase at the ages over 61.

In general, the curves of the normal reactions follow each other closely. In the abnormal reactions (except at the younger ages) the hypoactive and hyperactive systolic reactions follow each other closely; the greatest disagreement is in the abnormal diastolic reactions. Here we have, in the ages up to 20, an equal percentage of hyperactive and hypoactive reactions. The lines then diverge widely, the greatest divergence being from ages 31 to 40 where there is preponderance of hyperactive reactions with a minimum percentage of hypoactive reactions. Is it not reasonable to suppose that the elasticity of the arterial system, up to age 40, may be responsible for this increase in diastolic hyperactivity and a corresponding decrease in the percentage of hypoactive cases? As the older ages are approached, the two lines, *D and F,* cross each other and again diverge widely and finally come together at the ages over 61. It will be seen that, in the older ages, there is a preponderance of hypoactive reactions with a corresponding decrease in hyperactive reactions. Here again is it

not reasonable to suppose that the decreased elasticity of the arterial system in the older ages may be responsible for these findings?

To sum up, when classified according to age, 50% or more give normal reactions in the younger ages, the percentage for both systolic and diastolic pressures gradually decreasing to about 34% in the older ages. The abnormal systolic reactions are equally divided between hypoactive and hyperactive reactions except in the younger ages where there is a preponderance of hypoactive reactions. The abnormal diastolic reactions show in the younger ages a preponderance of hyperactive reactions and in the older ages a preponderance of hypoactive reactions.

Classification as to Weights

The whole group of cases was divided into those who were 11% or more over weight, those who were 11% or more under weight and those who came between these two limits.

Line A represents the systolic reactions of the overweights. It will be seen that less than half show normal reactions and that there is slightly higher percentage of hyperactive than of hypoactive reactions.

Line B represents the diastolic reactions of the overweights. It will be seen that the greatest percentage show hypoactive reactions. Note also that only 28% of the overweights show normal diastolic reactions as against 42% showing normal systolic reactions.

Line C represents the systolic reaction of the un-

derweights. It will be seen that the percentage of normal reactions is about the same as that of the overweights, but that in the abnormal reactions there is a preponderance of hypoactive reactions.

Line D represents the diastolic reaction of the underweights. It will be seen that nearly half show normal reactions, and that in the abnormal reactions there is a preponderance of hyperactivity.

Line E represents the systolic reaction of what we might call the normal weights. It will be seen that well over 50% show normal reactions, and that among the remainder there is a preponderance of hypoactivity.

Line F represents the diastolic reaction of the normal weights and again it will be seen that over half show normal reactions, the remainder being equally distributed between hypoactivity and hyperactivity.

To sum up, this group shows that so far as systolic reaction is concerned, the highest percentage of normal cases is in those of normal weight. The highest percentage of hypoactive reactions is in the group of underweights, whereas the lowest is in the group of overweights. The highest percentage of hyperactivity is in the group of overweights, the lowest in the group of normal weights.

In studying diastolic reactions, it will be seen that the highest percentage of normal reactions was again in those of normal weights, the lowest percentage being in those in the group of overweights. This situation is reversed in the case of hypoactive reactions, *the percentage of overweights showing this type of reaction predominating.* Hyperactivity of the diastolic reaction

is about the same for all groups. It would seem that the outstanding feature of this chart is the increase in the percentage of hypoactive reactions of the diastolic pressure in the overweights.

Classification as to Pulse Pressures

The total number of cases was then subdivided into those who showed a pulse pressure of 50 or less; those who showed a pulse pressure of 51-60; 61-70; 71-80; and over 81. *Chart XVIII.*

Line A shows a percentage of normal systolic reactions. It will be seen that there is a slight gradual fall with the higher pulse pressures.

Line B represents normal diastolic reactions. This line, though somewhat broken, follows in general that of the normal systolic reaction, the fall in the higher pulse pressures being somewhat greater.

Line C represents hypoactive systolic reactions. In the lower pulse pressures, the percentage is smaller than the line shown representing normal reactions and there is a gradual increase with higher pulse pressures, the two lines finally converging.

Line D represents hypoactive diastolic reactions. The percentage of this type of reaction decreases, apparently, with increasing pulse pressure, the highest number being in pulse pressure up to 60.

Line E represents hyperactive systolic reactions. The percentage is quite small in the lower pulse pressures and increases as the pulse pressure increases.

Line F represents hyperactive diastolic reactions. The percentage is small in the lower pulse pressures and increases very rapidly.

The various types of systolic reaction show divergence in the small pulse pressures, there being a preponderance of normal cases with a minimum of hyperactive reactions. As the higher pulse pressures are approached, the lines tend to converge with some preponderance of hyperactivity.

The diastolic reactions show divergence in pulse pressures of 50 or less with a preponderance of normal cases. There is a tendency of the normal and hypoactive lines to converge up to pulse pressure of 60 and then there appears, as the higher pulse pressures are approached, a divergence of the normal and hypoactive reactions with a terminal convergence. The hyperactive reactions show a constant and marked increase with higher pulse pressure. The outstanding feature of this chart appears to be the great increase in the number of hyperactive diastolic reactions as higher pulse pressures are approached, along with decrease in number of normal and hypoactive reactions.

Chart XIX is a study of the types of reaction found in groups showing changes in pulse pressure as a result of the cardio-respiratory test. The cases were divided in those reactions in which the pulse pressure increased more than eight millimeters as a result of the test, those in which pulse pressure decreased more than eight millimeters and those which would be included between these two limits.

Line A represents systolic reactions of those cases which showed increased pulse pressure. It will be

seen that there were an equal number of normal and hyperactive reactions with a relatively smaller number of hypoactive reactions.

Line B represents types of diastolic reaction in this group. It will be seen that there is a marked preponderance of hyperactive diastolic reactions in this group with a minimum of hypoactivity.

Line C represents the systolic reactions where the pulse pressure is decreased more than eight millimeters. It will be seen that there is a slight increase in the number of hypoactive reactions with relative decrease in hyperactivity.

Line D represents the types of diastolic reaction where the pulse pressure is decreased. It will be seen that there is a slight preponderance of the normal reactions, the remainder being equally divided between hypoactivity and hyperactivity.

Line E represents the systolic reactions of those in whom the pulse pressure remained within the above limits. It will be seen that there is a marked preponderance of normal systolic reactions with decrease in hypoactivity and hyperactivity.

Line F shows a diastolic reaction of this group. It will be seen that again there is an increase in normal reactions with a decrease in hypoactivity and hyperactivity.

The outstanding features of this chart are as follows: The increased per cent of hyperactive diastolic reactions in the group which shows increased pulse pressure; the increased hypoactive systolic reactions in the group showing decreased pulse pressure,

with a decrease of the same type of reaction where the pulse pressure was increased; the increase in the number of normal systolic and diastolic reactions where the pulse pressure did not change more than eight millimeters in either direction.

Types of Reaction With Myocardial Weakness

Certain types of systolic reaction have led us to suspect with reason that there is a definite myocardial weakness. In the group of cases under study, 26 such cases were found.

Chart XX shows a graphic study of this group.

Line A represents systolic reactions. There were no normal cases. The vast majority showed hypoactive systolic reactions and a small percentage showed at first a tendency to hyperactivity with final evidence of myocardial weakness and fatigue.

Line B represents the diastolic reactions of this group of cases. It will be seen that a majority, nearly 60%, showed hypoactive reactions, the remainder being equally divided, normal and hyperactive reactions. In the resulting chart, the diastolic line shows the same tendency as that which represents the systolic reaction.

Summary

(1) The diastolic reaction in any given case is not necessarily of the same type obtained for the systolic pressure.

(2) There is, however, a definite tendency to agreement in type.

(3) In a group of abnormal diastolic reactions, the younger ages are more apt to give a hyperactive diastolic reaction and the older ages a hypoactive reaction.

(4) There is a definite tendency for overweights to give a hypoactive diastolic reaction.

(5) There is a definite tendency for cases with high pulse pressures to give a hyperactive diastolic reaction.

(6) Cases with cardiac weakness and fatigue give, in general, hypoactive diastolic reactions though not to as great an extent as in the case of the systolic pressure.

Dr. Beckett—I will ask Dr. Oscar H. Rogers to open the discussion on these two papers.

Dr. Rogers—I had hoped to be able to submit at this meeting a definite statement of the results of our work in the New York Life with the cardio-respiratory test, but an examination of the material satisfied me that it was too fragmentary to warrant any clear-cut deductions from it. We have used the cardio-respiratory test in five or six hundred cases and we are still studying it. Some of our medical staff have mastered the technic and have learned pretty well to interpret the results, following the rules so carefully laid down by Dr. Frost and his associates. Some of our examiners have made very little progress in its use and have been most ingenious about finding reasons for not mastering it. Personally, I have not been able

to meet the situation as completely as I should wish, for the reason that I have found difficulty in my own mental complex in making the test. I am inclined to think that I belong to the 15% of people who never succeed in using the test, and it is perhaps because of my own personal discouragement in the matter that I have met with so little success among my colleagues, who, in the main, are good medical examiners. I believe that there is a good deal to be learned through the use of this test and that it is a fair measure of the present efficiency of the heart. I am not prepared to go so far as my friends in the New England Mutual are going in assuming that, because a suspected heart is bearing well its burden of today, it will continue to do so, as if it were a normal heart.

The present mortalities in the New England Mutual groups of cases which have been subjected to the test, are very encouraging but the question still remains whether these hearts, which bear the strain today, will continue to bear the strain in years to come or will they break down more quickly. I like very much Dr. Wilson's suggestion with regard to the use of the sphygmomanometer to measure in cases of irregular and intermittent pulse the uniformity of the force of the heart's contraction. Something of this sort, pursued intensively along the same lines and with the splendid spirit which our colleagues in the New England Mutual have shown with regard to the cardio-respiratory test would be of immense value to us. My own reaction is that we need something simpler than this test—indeed, that whatever we finally employ, must be something which may be usd by any man with fair training anywhere. I do not mean by this that I think the cardio-respiratory test, as now carried on, may not some day be used in the broad sense that I am bespeaking. I want to

see more intensive work done by many of us in that direction. So far as the New York Life is concerned, we shall continue to employ it, not as the final hurdle but as a means of throwing some additional light on the subject. We shall also follow Dr. Wilson's suggestion and I am hoping that other members of the Association will bring out other comparatively simple tests. So far as any of these tests of the heart is concerned, I doubt that it will do any more than tell us that the heart at the time of our examination of it is able to stand the strain.

With regard to the work that the New England Mutual has been doing for a number of years for the advancement of medical selection, the work of Dr. Dwight, Dr. Frost, Dr. McCrudden, Dr. Amiral and Dr. Brown, I should like to say that I feel a deep sense of obligation to all of these gentlemen for their splendid work. They are pioneers in a field that too few of us have ventured into. Several years ago, when Dr. McCrudden presented his paper on "Glycosuria," my first reaction to it was, "Good Lord, 250 to 300 items of bibliography. Life is too short and we have too many things to do to keep up with such detail." That was my first reaction. Since then I have come to feel that Dr. McCrudden's work is splendid and marks in a way an epoch in life insurance medicine. In the same way I feel very strongly that the work of Doctors Frost and Amiral in their field is extremely valuable and that of Dr. Brown in his elaborate researches in his field. There is no doubt that the work that these gentlemen are doing represents a type that we must all be doing and doing intensively in every one of our offices if we expect to contribute our fair share towards the science of life insurance medical selection.

We who have been working over the problems of medical selection from the standpoint of the use of the material that we have on hand in the records of our various companies, have very nearly completed our work. We have laid down among us the broad lines of medical selection so far as the large groups are concerned. Dr. McCrudden emphasized that point very strongly in his paper read at a recent meeting of the American Life Convention and very properly took the position that future medical selection must be selection within the groups. The groups have been blocked out as a whole. It now remains for us to find a means of distinguishing within the groups between those who are better than their class and those who are less desirable. The only way we can do this is by following some such methods as Dr. Frost and his colleagues are suggesting. We must do this if, in our medical selection, we would advance beyond the point of treating these abnormalities in the mass. I am in the most complete sympathy with this work and have only admiration for the people who have contributed so splendidly to our efforts.

With regard to Dr. Brown's paper, I could not make out from it whether he was working on single specimens or specimens furnished over a period of time. I should imagine from the nature of his statements that he was requiring two-hour specimens. Am I right?

Dr. Frost—Single specimens.

Dr. Rogers—I should imagine that the element of time enters quite largely into a problem of this sort. A number of years ago, when I was visiting at Battle Creek, where they make a very great number of analyses of urine every day, I made an attempt to do what Dr. Brown has been doing but I did not succeed in

finding any one factor that seemed promising as an infallible, or nearly infallible, guide. I am, therefore, doubtful whether we shall ever be able to find in any single specimen of urine the evidence of renal efficiency which we should like. This is certain, however, that, although we may not agree in the creatinine test, we may not agree regarding the cardio-respiratory test or as to whether the blood sugar determination should be made 2 hours or 2 1/2 hours after the dextrose, we, I am sure, agree that these gentlemen are doing work along lines which we all must follow if we are to go much further than we are at present in the science of medical selection.

Dr. Beckett—Dr. Muhlberg.

Dr. Muhlberg—The next time I am asked to discuss a paper, I am going to find out whether or not Dr. Rogers precedes me in the discussion. The doctor has a very discouraging way, not only of saying about everything that you yourself have to say, but saying a whole lot of things you would have liked to say if you had thought of them, but nevertheless the points that he brought out are so important, this paper itself is so important, that even if I do repeat many of Dr. Rogers' observations, I think reiteration will be of value.

No subject presented to the Association within the past few years has excited more interest and comment than have the cardiovascular studies made by the New England Mutual Life Insurance Company. Their investigations have appealed to us, not only on account of the thoroughly scientific and painstaking methods with which they have been conducted, but because we recognize that they blaze a path into a wilderness where light is very much needed.

I can conceive of no especial reason why I should have been called upon to discuss Dr. Frost's and Dr. Amiral's very excellent papers, except that some years ago I had hoped to specialize in the physiology of the circulation. No doubt, I am expected to discuss the purely physiological aspects of this test and as a matter of fact, I have been interested in this phase of it from the beginning. But unfortunately, there are so many factors involved—variations in thoracic and abdominal pressures, reflex nerve influence and mild asphyxial reactions, that I feel my opinion would be of very little value. I consulted two other physiologists of prominence and, somewhat to my surprise, they too, felt that the problem was a very complicated one.

However, there are certain fundamental factors involved that can be recognized and that no doubt in a general way may account for most of the reactions. A negative thoracic pressure will after a short preliminary drop, increase the systolic systemic blood pressure through the suction action of the thorax on the blood in the abdominal reservoir, the heightened blood pressure being due principally to the increase in volume of blood sucked into the thorax and pumped through the heart. A positive thoracic pressure acts reversely. A positive abdominal pressure, on the other hand, will force more blood from the splanchnic venous area into the thorax and likewise raise the pressure, and at the same time offer greater resistance to the entrance of the arterial blood into the abdomen, and thus in all probability increase the diastolic blood pressure.

Complications arise, however, in connection with combinations of varying thoracic and abdominal pressure and these are difficult to evaluate; but I am in-

clined to believe that the decreased systolic pressure and the increasd diastolic pressure of Step 2, for example, are due respectively to an increased thoracic pressure obstructing the venous flow from the abdomen to the heart, thus reducing the systolic blood pressure, and the increased abdominal pressure from the descended diaphragm increasing the resistance to the arterial flow into the splanchnic area and hence raising the diastolic pressure.

Most of the reactions of the other phases are perhaps susceptible of a similar explanation. On this basis, Dr. Amiral's studies beautifully compliment the earlier studies of Dr. Frost. But after all, the theoretical considerations are largely academic—and if I have rushed in where the angels feared to tread, I can at least offer in extenuation that physiologically the test is a most intriguing one.

The test itself appeals to me as being the best of the numerous tests that have in the past been devised for studying the efficiency and competency of the heart, in that it subjects the heart to wide fluctuations of systolic and diastolic blood pressures through the medium principally of varying the amount of blood to be handled by the heart cavities. Other tests depend principally on fluctuations brought about through varying the rate of the heart beat, or through nervous influences or asphyxial effects, none of which would appear to me to be as informative as Dr. Frost's test.

There are of course, certain difficulties in connection with the test. It is not easy to apply. The examiner must be expert in its use. The apparatus is expensive. The fee paid the examiner is a heavy overhead expense per application for small amounts of insurance. The applicant must be sufficiently intelligent to re-

spond to the requirements. I must confess, too, that in my limited experience I have not usually been able to perform the test within the time limits assigned, namely—7 to 10 minutes.

Unfortunately, the test is not as simple as one would desire for insurance work and Dr. Frost, recognizing this difficulty, suggested in a previous paper that perhaps Steps 4 and 5 might be omitted. I note he has now dispensed with Step 5 and it is to be hoped that a further experience may warrant a further simplification—perhaps the omission of Step 4.

After all, the most significant development of these studies is the mortality ratio experienced among those who were issued insurance after undergoing the test. The figures giving the death ratio by lives of over 3,000 policyholders—25.59% by the American Experience Table and 48.20% by the American Select Table, are as satisfactory as one could hope for among standard lives.

Assuming these figures to be accurate—and no one who is acquainted with Dr. Dwight's wide experience and scientific mind can for a moment doubt their accuracy—we are forced to the conclusion, if we decline to rely on them, that either a mortality experience based on some 3,000 lives over a period of five years is not a reliable index, or that there has been a superselection that is truly remarkable. I do not believe that most of us would concede that our medico-actuarial methods are unreliable when applied to this number of cases, for such a period, but it is possible that the New England Mutual method has given us a means of superselection that is most effective for five years at least. I feel that Dr. Frost ought to continue to advise us annually whether subsequent experience among

these cases continues to demonstrate the correctness of his methods.

Personally, I know that a superselection can at times show remarkable results. Five years ago the company I represent decided to enter the Substandard field, and I suggested that temporarily, the company retain only the best of the Substandard cases and reinsure the rest. Our selection was very rigid, with the result that the mortality so far among the Substandard lives we retained has been considerably lower than the average of Standard lives for the same period of exposure, but no doubt the business will run true to form in a few more years.

After all, the risk of a heart with a valvular lesion is not solely due to a lack of compensation or impaired heart muscle. Organic heart cases do not weather so well attacks of pneumonia, influenza, etc. Very often there are recurrences of the acute endocarditis which primarily caused the lesion. Coronary artery disease is more likely to develop in hearts taxed abnormally by endocardiac abnormalities, and the mitral lesions are particularly prone to auricular thrombosis. It would, of course, be unreasonable to hope that any heart test could protect entirely against such disasters, and the fact that about one-half of the death losses reported were due to heart complications indicates that such conditions cannot be entirely averted.

One would on theoretical grounds be even more dubious as to the value of the test in connection with the other impairments accepted because a normal heart might co-exist with an incipient hypertension, or goitre, and therefore, be no accurate gauge of the seriousness of the impairment. But theory in science must always give way to facts, and if experience based

on facts upholds the validity of the test—and it seems to do so according to the New England Mutual's experience—we cannot scientifically assail the essayist's position except with further experience and new facts.

Dr. Frost is to be complimented on the skill displayed in his interpretation of the reactions. It is quite evident that it would be useless for me to discuss his methods because, after all, the real test is experience; and since those whom he considered eligible have shown a favorable mortality, whilst those he rejected have shown a larger number of deaths, it is obvious that his criteria are in the main correct. No doubt, with a more extended experience, modifications may be required, but these very probably will be in the nature of refinements of differentiation.

There is even a broader principle involved in Dr. Dwight's work that I believe ought to be stressed. It is not improbable that the actuarial-medical methods that have yielded such brilliant results in the past few years cannot much longer be expected in the future to be quite so fruitful. Much, of course, remains to be done, but I venture the thought that it will mostly be along the lines of refinement and differentiation of our present data.

Sciences stagnate unless they venture into new waters. Physiology appeared almost moribund at the close of the graphic method period, and then blossomed into new life through the stimulus of physiological chemistry. If we expect to progress, we must not only give every encouragement to the pioneer (and Dr. Dwight's work is pioneer work, just as has been the work of Dr. Rogers and Dr. Fischer), but I think we ought to do our share in collaborating with those Medical Directors who feel they have found new fields.

Personally, I would be willing to recommend to my company that we accept about one hundred of these cases for amounts of $5,000 or less, preferably on Endowment Plans, with a view of contributing to Dr. Frost's statistics. Even assuming that they should finally develop into substandard risks—and I doubt it —the cost on the basis of a 50% extra mortality would not be over $2,000 or $3,000 a year, and money spent in this way would be returned a hundredfold in our gain of knowledge.

If every other company would accept a relatively equal quota, the material abundant to settle the question would soon be available. I figure the Union Central quota as being about 2%.

As a matter of fact, I have already approved two cases on the basis of Dr. Dwight's test and if I could procure the name of one of his examiners in each of the larger cities who are qualified to do the test, I would be willing, if my executive officers consented and if other companies followed suit, to take a full quota in the interests of progress in our special field of medical selection.

Dr. Beckett—These papers are now open for discussion. We would be glad to hear from anyone else regarding their views on this important topic. If no one else cares to speak on this subject, I will ask Dr. Frost to close the discussion.

Dr. Frost—I wish to comment first on the difficulty of teaching and applying the test. We recognize perfectly that it is not a test that any practitioner can read up and apply the first time as he might, for instance, the ordinary exercise test. It is nothing of that sort. As I have outlined in my paper, even with careful instruction, at least as

careful as we could give, 15 per cent of the examiners whom we have chosen to apply the test have not given satisfactory results. The other 85 per cent, on the other hand, are doing it to our complete satisfaction. Some of them have picked it up much more readily than others.

As far as we are concerned—and we are using the test now throughout our entire organization, having some 110 examiners doing it in 69 different agencies—we have been able to teach 85 per cent of them to do it satisfactorily. So far as the reactions themselves are concerned, I have analyzed in my paper 3,500 applicants. To those were given 4,000 tests. Of those 4,000, 5 per cent have been unsatisfactory, partly because of the examiner's lack of skill in the test, partly on account of the lack of co-operation on the part of the subject, partly on account of the development of what were considered abnormal cardio-vascular signs during the test.

As regards the significance of the test, mentioned by Dr. Rogers, we do not consider that the test gives us any guarantee as to longevity. Of course, that would be foolhardy, but we do consider that it indicates the condition of the circulation at the time of the examination. I think we will all agree that if this method or any other method enables us to start on the basis of a properly functioning circulation, we have advanced a long way in the selection of cases with circulatory impairment.

Dr. Rogers mentioned Dr. McCrudden's work on blood sugar. I want to take this opportunity to give you an idea of what we have done with that to the present. That test, as you will remember, consists of the ingestion of 100 grams of glucose, either on a

fasting stomach or immediately after a meal—it doesn't matter—and taking a specimen of the blood exactly two hours after and determining the sugar content. Our upper limit of normality is 120 milligrams. We have been using that now for exactly four years. During that time we subjected 836 applicants to the test. We found that 64 per cent of those gave us a blood sugar content lower than 120 mg., so that we considered them for standard insurance. We have no figures as to mortality. Up to the present, we know of one death, due to pneumonia.

With reference to Dr. Muhlberg's scheme for co-operative study, I merely wish to say that if any of the companies wish to use our examiners over the country who have been taught to apply the test, we would be very glad to give them their names and make them available. During these five years, we have had in all 5,231 applicants to whom the test has been given, and we have accepted for insurance, on some form, 64 per cent of them. About half of that insurance by amount was on the Ordinary Life plan and the rest of it on the modified forms. In my paper I have given analyses of the way the forms which we give differ according to the variation and severity of the circulatory impairments. Our mortality up to the present has been 25 per cent by the American Experience Table and 48 per cent by the American Men's Select. It might be of interest to know how that compared with our general business over approximately the same period. The mortality of our general business was 34 per cent by the American Experience Table, while the mortality on this is 25 per cent. Now, of course, they are not strictly comparable, as I understand from our actuary

that these cardio-respiratory cases are not so heavily weighted in the earlier years as are cases making up our general business.

As far as we have gone, we are perfectly satisfied and we intend to keep on until we have satisfied ourselves permanently. How long that will be, we don't know. I thank you.

Dr. Beckett—We are surely indebted to Dr. Frost for a continuation of the results of these important investigations.

The next paper to come before this Society is "Cardio-Vascular-Renal Disease in Medical Selection" by Dr. Henry Wireman Cook of the Northwestern National Life Insurance Company. Dr. Cook.

Dr. Cook—My paper is merely a general discussion of cardio-vascular-renal impairments and is printed in full so that I will not burden you with any of it at this time.

The general argument is somewhat along the line brought out by Dr. Rogers and other speakers this afternoon, that any improvements in our methods of selection must lie in the future along refinements of the general broad classes that have already been laid down. If Dr. Dublin is in any way correct in his estimate of the incidence of cardio-vascular-renal disease, it certainly is a subject that deserves our most careful consideration. He estimates that there are about two million cases of heart disease in this country at the present time, and statistics show that vascular and renal disease, if combined with heart disease, will about double the total number, so that there are in all probability about four million cases of cardio-vascular-renal disease, most of them in the insurable ages.

In going somewhat extensively into the literature, I was very much impressed by one sign that practically all clinicians emphasize, particularly within recent years, in estimating the seriousness of cardiovascular-renal lesions and that is cardiac hypertrophy and dilation. Practically all of the clinical observations that I have been able to review lay the greatest emphasis on cardiac hypertrophy and dilation as the best single indication of myocardial integrity. We have been so much impressed by it in recent years that we have been using the X-ray more and more in our larger cases, getting a fluoroscopic opinion from some local man, wherever the case may be, and guiding our action on the basis of cardiac size. At the present time we are planning to put an X-ray machine in our Home Office. I was talking to Dr. Knight at luncheon today, and he told me that they have an X-ray machine in the Metropolitan Home Office. They are using it, I believe Dr. Knight said, primarily for the examination of new employees, but they are also using it for the examination of certain types of applicants.

The instrument that I was particularly interested in seeing in operation recently was a modification of the fluoroscope called the orthodiascope. It has been in use on the continent in Germany and other European countries for at least twenty years, but is very little used in this country. As you know, the fluoroscope gives you a distorted image in the picture owing to the divergent rays running from the subject to the plate from distances of five or six feet or so. The orthodiascope traces the outline of the heart or any organ that you may desire to trace through a single point so that you get only the

central rays and do not get the divergent rays, and, therefore, do not get any distortion. I have reproduced the tracings on four heart cases that were given to me by Dr. Fahr of the University of Minnesota. Dr. Fahr thinks it is by far the most accurate instrument for determining heart size. Authorities agree that heart size by the orthodiascope is possible of estimation within half a centimeter.

I was so much interested in the machine that we want to put one in in connection with our X-ray apparatus that we are to install at the Home Office, and I asked the Kelly-Koett firm if they would be good enough to have one here to show you, and they agreed to very kindly. The orthodiagram is taken on a sheet of paper by means of pin point perforations and then afterwards the outline is traced in with a pencil. It can be filed with the papers, and a consecutive record can be kept over a number of years, making it possible to note any change in cardiac size. I believe it is practical in insurance work. Of course, it isn't practical for the average field examiner, but our larger cases are coming more and more to be examined in the large centers of population. You can get a competent fluoroscopic opinion now in almost any city of 10,000 population and my own opinion is that we are going to use more and more frequently in the immediate future an X-ray of the heart, a fluoroscopic opinion of the heart or an orthodiagram of the heart as a gauge of cardiac hypertrophy.

CARDIO-VASCULAR-RENAL DEGENERATION

By Henry W. Cook, M. D.

Vice President and Medical Director, Northwestern National Life Insurance Company

The most valuable contributions which have been made to the literature of medical selection, we would all probably agree were the results of statistical research into the mortality experience in large more or less homogeneous classes, such, for example, as Dr. Symonds on family history, Dr. Fisher on blood pressure, Dr. Grosvenor on heart murmurs, Dr. Weisse on overweights, Dr. Dublin on heart disease, and especially, of course, the notable work of Dr. Rogers and Mr. Hunter and the medico-actuarial investigation.

Presentations of this kind require large volume, and usually have been restricted to the larger companies, or, as in the case of the medico-actuarial investigation, to aggregations of companies. This will gradually change as the smaller companies come to be better organized and in a position to analyze their experiences, either singly—for it is recognized that even small groups if homogeneous will prove sensitive indices, or better still, in groups of smaller companies, a number of which now exist for the distribution of reinsurance coverage. The use of a common mortality tabulating card and the taking off of experiences by various companies as a routine part of the clerical work will make an increasing volume of experience available.

So striking and so revolutionary have been the developments of statistical experience within the past

two decades in determining underwriting action, that we are inclined, in meetings of life underwriters, to be impatient of any contribution other than a definite table showing an experience which will enable us to dispose of our cases promptly by the application of numerical ratings. Yet it is equally essential that we realize that medicine is a rapidly advancing and changing science, and that a very open and receptive mental attitude must be maintained if we are to keep our statistical branch of medicine from becoming frozen into invariable formulae. I recognize such a tendency in my own attitude, especially since the introduction of the underwriting manual. Unfortunately, the written word is too readily accepted as carrying the authority of sanctity and infallibility. I recall, when privileged to visit with Dr. Rogers twenty-two or twenty-three years ago, soon after he had completed his epoch-making impairment manual, that he referred to it whimsically as his Bible. Not all of us, I fear, leaven our appreciation with his fine sense of humor, and we may take our manuals too seriously. They merely represent an attempt to assemble in convenient form comparable standards of our underwriting knowledge available to date, but are a long way from being the last word. Life insurance underwriting is a far bigger profession than merely the routine application of certain percentages, just as banking is far more than the use of an interest table. Though in practice the numerical method is our best instrument, it is, after all, only an instrument, or—as Dr. Rogers has aptly called it—a yardstick. We need not only continually revised statistics, but we need as well a receptive clinical viewpoint in order that we may correctly assemble and interpret our

statistical data. If we merely accept the statistical experience now available and allow our manuals to become arbitrary and inflexible guides to routine action, our standards of underwriting practice will soon become obsolete, and we shall lose the ability to modify our judgments as required by the rapidly changing conceptions of clinical medicine, as well as by the new statistical data constantly made available.

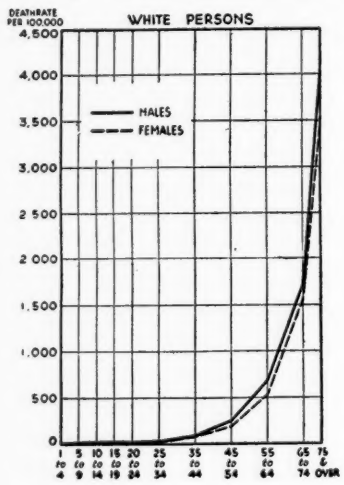
I have not a statistical contribution to offer, but, since honored by Dr. Beckett's request for a paper, have attempted to present some comments on a phase of clinical medicine which is of great underwriting importance.

In no field of our experience is it more necessary to maintain the nice balance between clinical knowledge and statistical experience than in the large and increasing groups of cardio-vascular-renal impairments. Our clinical conceptions of these conditions have changed repeatedly during the past few decades, and our statistical evidence has altered almost as widely during the same period. Henry Christian (1) calls attention to the fact that when he ended his medical course twenty-six years ago no mention of cardiac infarction was made as a condition to be recognized during life. Now, Harvard students in their fourth year consider it and diagnose a condition which was hardly known twenty-five years ago. When we think of the contribution which accurate blood pressure estimations alone have added to our knowledge of heart disease, and realize that only twenty-five years ago blood pressure did not enter into either clinical or statistical decisions, we can appreciate how essential it is to keep receptive to new clinical methods as well as constantly changing statistical evidence.

It was just twenty-four years ago that I had the privilege of first demonstrating a sphygmomanometer before a group of life insurance medical directors. I remember so well the varying reactions of different types of men. The medical director of one of the largest New York companies declared it an interesting toy, but nothing that an insurance company with its large volume, etc., could ever consider seriously. The same day I called on Dr. Rogers, and he immediately saw the possibilities of the sphygmomanometer and began to work on models of a more compact portable instrument. Since the sphygmomanometer we have had quantitative sugar and albumin, and blood sugar, and we may be assured that these will not be the last mechanical aids to accurate selection, nor will our present ratings or conceptions represent even approximately the last word in evaluating the signs or symptoms referable to the cardio-vascular-renal system.

A statistician, Dr. Dublin, has probably done more than any other one man to focus both professional and lay attention on the very serious problem of organic heart disease. He has estimated that one in every five of the population living at age ten will eventually die of organic heart disease, that the child of ten is now three times as likely to die eventually of heart disease as from tuberculosis, and that as we approach the more common insurable ages the incidence increases. At age thirty-five the probability of dying of heart disease is four times that of dying of tuberculosis. Of the 20,000 deaths from heart disease among Metropolitan Life policyholders in a single year, 17 per cent were under age forty, and 83 per cent over forty.

Deathrates per 100,000 for Organic Diseases of Heart
Metropolitan Life Insurance Co., Industrial Department, 1923

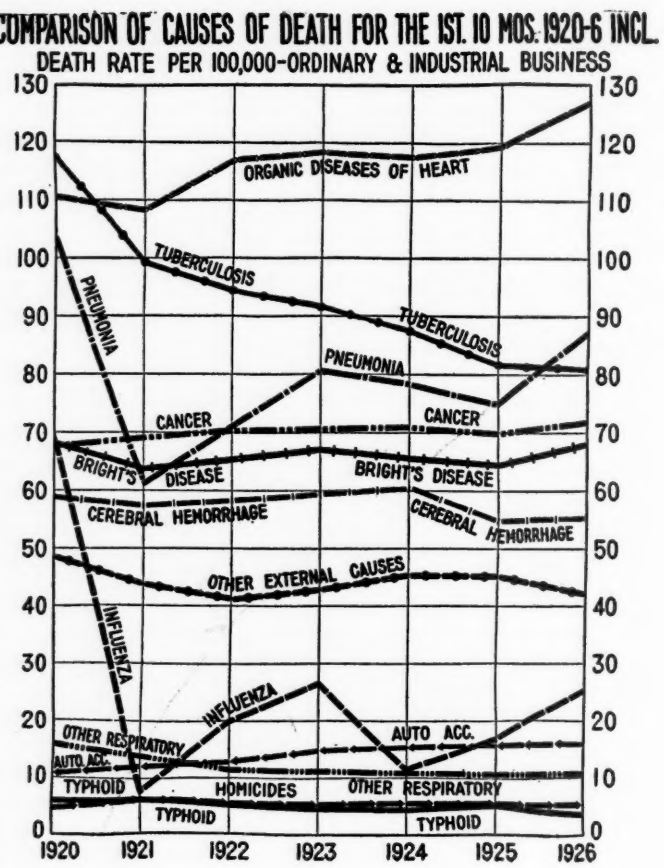


Dr. Dublin also points out a fact of special interest to us now, in view of the vogue of the disability clause —that in most instances these deaths involve not only a loss of many years of productive life, but often years of complete invalidism prior to death.

There are in this country 2,000,000 people ill with heart disease, and 200,000 deaths annually. Deaths from arterial disease (apoplexy) and Bright's disease, closely parallel the heart disease curve, and double the total loss from the combined cardio-vascular-renal impairments.

Henry S. Nollen (2), reporting the collaboration of fifty-two life insurance companies, of a total of 270,912 death losses in 1926, gives a graphic picture of the mortality rates for principal causes:

"In order to get a mental picture of the present relative importance of fatal disease, let us imagine an average community of 100,000 policyholders, and apply the experienced loss ratios for this year. The greatest number of deaths have been caused by organic diseases of the heart, numbering 127 victims. Pneumonia ranks second, with 88; then follows tuberculosis with 81 deaths; and fourth in order is cancer, with a toll of 72. Bright's disease caused 68, and apoplexy 56 deaths. * * * This is an increase over the preceding year of approximately 4 per cent, or about 33 deaths, composed of the following changed conditions: The largest increase in the ratio of fatalities was due to pneumonia and other causes in the order named—influenza, organic heart diseases, Bright's disease, cancer, apoplexy."


COMPARISON OF CAUSES OF DEATH FOR THE 1ST. 10 MOS. 1920-6 INCL.
DEATH RATE PER 100,000-ORDINARY & INDUSTRIAL BUSINESS
130
120
110
100
90
80
70
60
50
40
30
20
10
0
ORGANIC DISEASES OF HEART
TUBERCULOSIS
PNEUMONIA
CANCER
BRIGHT'S DISEASE
CEREBRAL HEMORRHAGE
OTHER EXTERNAL CAUSES
INFLUENZA
OTHER RESPIRATORY
AUTO. ACC.
TYPHOID
HOMICIDES
1920
1921
1922
1923
1924
1925
1926

During the past twenty years—which really represent the period of modern underwriting—a very variable emphasis has been laid on the different organs involved in these chronic degenerative conditions—the arteries, the kidneys, the heart. Twenty-five or thirty years ago arteriosclerosis was a favorite diagnosis for the man in the sixth or seventh decade who began to fail—who perhaps showed thickened arteries, radial or temporal, a trace of albumin, a little shortness of breath, etc. The term "arteriosclerosis," the phrase, "A man is as old as his arteries," became popularized, and the layman accepted arteriosclerosis as a satisfactory diagnosis. About the same time, the more frequent use of chemical and miscroscopical urinalysis, and the consequent finding of albumin and casts, popularized the conception of Bright to such an extent that Bright's disease became a very common and popular diagnosis, accepted and used by the laity in a similar group of cases. Later the work of Mackenzie and others focused attention on the heart, and myocarditis became the medical term for the condition which the layman described as "heart failure" or "heart disease." More recently, the sphygmomanometer has popularized the arterial tension aspect of these conditions, so that now we hear of our own friends and contemporary relatives having "high blood pressure," whereas the contemporaries of our parents had arteriosclerosis or Bright's disease.

There can be no question that in many of these cases the diagnoses of arteriosclerosis, Bright's disease, myocarditis, or high blood pressure or hypertensive heart disease, do not in fact indicate a differential diagnosis of a distinct clinical entity, but rather a more or less accidental choice of a terminology which

is determined by the vogue of the period or school, or by the more distressing of the common clinical symptoms or more pronounced of the signs. The Metropolitan Life, in its mortality statistics in 1919 (3), made the following statement: "The several terms used by physicians may refer to precisely the same diseases and conditions in each of the cases, but, in the one instance, the assignment of the death is to a heart condition, and in the other to the condition of the kidneys." "The contour of the curve of mortality for Bright's disease, according to age is very similar to that for organic heart disease," and in the April, 1927, issue of their statistical bulletin (4) they speak of "All three of the principal 'degenerative diseases'—cerebral hemorrhage, organic heart disease, and chronic nephritis."

Morris Kahn (5), in the American Heart Journal for April, 1927, says:

"In aortic lesions and coronary arterial disease * * * the commonly associated lesions are those of arteriosclerosis, hypertrophied heart with hypertension, pulmonary emphysema, and chronic interstitial nephritis—all evidence of extensive arterial change."

Moschcowitz (6) shows clearly the widespread nature of the process, in his discussion of what he terms "by far the most common form of nephritis—arteriocapillary fibrosis," which he attributes to hypertension:

"Since the studies of Gull and Sutton, pathologists are now fairly well agreed that arteriocapillary fibrosis represents a disease of the vascular framework, and that the parenchymal changes are largely the result of the consequent impoverishment of the blood supply.

Furthermore, as Jores has shown, the vessels in other organs besides the kidney show profound arteriosclerosis, notably in the brain, the heart, the spleen, the skin, the retina, and the pancreas. In consequence, we must view this form of chronic nephritis not merely as a local vascular disease, but as an expression—probably the most prominent—of a general vascular disease. Indeed, clinically the extrarenal lesions are of far greater consequence than the renal, for it is these lesions that cause the bulk of signs and symptoms, and, in nine-tenths of the cases, death. It is curious that the brunt of the lesions should fall more upon one organ than upon the other, and why one patient will die of apoplexy, another of coronary disease, or heart failure, and another of uraemia. Finally, not only must we view this form of chronic nephritis as a malady of the larger vessels, but of the capillaries as well. This accounts for some of the cases of diabetes associated with hypertension, since there is arteriosclerosis of capillaries of the islands of Langerhans."

McLester (7), speaking of the same group of cases, but with special emphasis on the blood pressure feature, says:

"Today we must regard high blood pressure merely as a disease complex, often inherited, in which hypertension is the salient clinical feature, the exact pathogenesis of which is unknown, but which in its later stages is accompanied by disease of the kidneys, myocardium and arteries."

These individuals, as a group, have generalized arteriosclerotic changes in aorta, systemic arteries, kidneys, myocardium, and coronary and cerebral vessels; they have a tendency to hypertension, albuminuria of smaller amounts (.005 to .03), and mild cylindruria; they come to experience shortness of

breath or pain on exertion; they die of apoplexy and heart failure, uraemia, or a terminal infection.

We are very apt, in modern medicine, to devise a name and then attempt to fit the case to it, or to attempt to relate as cause and effect co-existing signs and symptoms. Up to a certain point this tends to assist in a differentiation of classes, but it may readily mislead us by determining a classification which is at best arbitrary and not based upon clear-cut distinctions.

It is interesting to remember that so eminent an observer as Potain, at a time when urine examinations were a new thing, believed that gallop rhythm was related to the finding of albuminuria. Later, when he developed his sphygmomanometer, he believed gallop rhythm was due to increased arterial tension. This became the popular view, and it is only lately that it has been abandoned for the theory that it is due to dilatation and myocardial change. Kauffmann (8) in 1894, and Müller (9) in 1906, among others, expressed doubt as to the causal relations between gallop rhythm and hypertension, but it takes a long time to overcome the acceptance of a popularized, though erroneous, viewpoint.

The original differentiation of Bright in directing attention to the part played by the kidney, marked a tremendous advance in our conception of these clinical cases, but the later refinements of classification of renal diseases have not been so satisfactory. The translation of pathological diagnoses into clinical groups corresponding to small granular kidney, large red kidney, etc., etc., has led us away from, rather than towards, a clearer understanding of renal disease. The mistake arises in the assumption that there must be

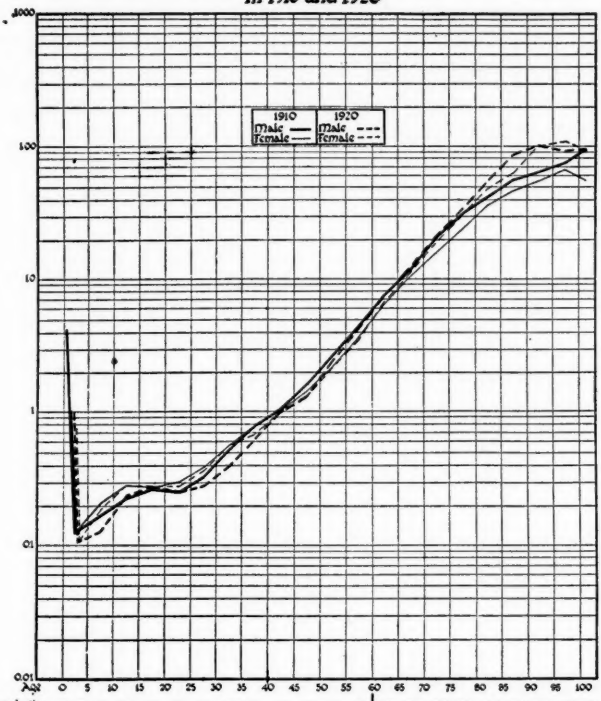
a distinct clinical disease entity corresponding to various clinical signs or to post-mortem findings for each organ, and the consequent attempt to establish such a relationship. The same mistake arose in connection with the differentiation of heart murmurs and the textbook classification of named diseases presumably corresponding to auscultatory or post-mortem findings; so we had mitral insufficiency, mitral stenosis, myocarditis, as though they were each clinical entities, running a more or less uniform course like typhoid fever or lobar pneumonia, and permitting of accurate diagnosis and statistical classification.

This over-zealous effort at exact differential diagnosis in the end leads to great confusion, both in individual clinical treatment and in massed statistical analysis. Diametrically contradictory points of view come to be held by equally eminent observers. For example, the medical directors of several of our largest companies speak of analyzing so many thousands of cases of mitral insufficiency, and the Professor of Medicine of Harvard University (10) says at about the same time that mitral insufficiency is a clinical rarity and cannot be diagnosed during life.

Can we escape from the controversial problems arising from extremes of differential diagnosis and profitably attempt to view this problem from a more practical clinical and underwriting viewpoint? Chronic diseases of the heart, arteries, and kidneys are steadily and rapidly increasing, the curve of their incidence being upward and reverse of the curve of the incidence of infectious diseases, which is falling. In other words, individuals who do not succumb to accident or infection, live to the more natural termination by morbid changes in one of the three most vital organs

—heart, arteries, kidneys—as a matter of fact, we might say of vascular disease, for the heart is, of course, a part of the vascular system, and the kidney is largely a vascular organ in its relation to a majority of chronic nephritics at ages past forty. If we exclude the cases of heart disease due to the two major cardiac infections, rheumatism and syphilis, and if we exclude the arterial disease due to syphilis and toxemia such as lead, and if we exclude the cases of nephritis largely tubular in character and due to acute toxemia such as alcohol, lead, scarlet fever, pregnancy, etc., there remains a very large group, comprising probably sixty to seventy per cent of all cardio-vascular-renal diseases, which have no constant etiological factor, which show a strong hereditary tendency, which begin to be manifest at around age forty and steadily increase to age 100, which show in varying degrees a number

Death rate per 1000 living of each age and sex for Heart Disease* in the U.S. Registration States, exclusive of N. Carolina in 1910 and 1920



*This includes Pericarditis - Acute endocarditis - Organic diseases of the heart - Angina pectoris - Diseases of the arteries - Embolism and thrombosis - Diseases of the veins - Diseases of the lymphatic system - Hemorrhage; other diseases of the circulatory system: Nos. 77 to 85 of the International List

* From Dr. A. E. Cohn's article in the American Heart Journal, April, 1927 (12).

of clinical signs and symptoms—hypertension, cardiac hypertrophy, variable murmurs at apex and base, thickened arteries, peripheral and retinal, a trace of albuminuria, cylindruria, low specific gravity, headache, shortness of breath, precordial discomfort or pain—and which terminate by apoplexy, angina or heart failure, or ureamia, unless interrupted by accident or a concurrent malady such as cancer or a terminal infection.

Is it correct to call one of these cases "mitral insufficiency" because of the finding of a systolic murmur; "hypertensive heart disease" because of hypertension; "arteriosclerosis" because of thickened arteries; "Bright's disease" because of albuminuria, etc.? The same case may show all these signs or symptoms, and usually does if the course of the process is not interrupted prematurely; or in the same case the emphasis may change as the condition progresses, and the clinical picture may in one year be predominantly nephritic, the next cardiac, and the next arterial. More and more frequently we are hearing the phrase, "chronic degenerative condition," or "senescent changes" rather than a named disease, such as Bright's, arteriosclerosis, etc. Cohn, for example, speaking of heart disease, expresses the opinion that the large majority of heart diseases do not actually represent a disease, but rather a senescent process.

The mortality curve for Bright's disease and arterial disease closely corresponds to heart disease. I believe that a very large percentage of nonspecific cardiovascular-renal diseases as manifested above age forty could more properly be regarded as a gradual aging process, primarily determined by the hereditary biological attributes of species, race, and family, and

modified favorably or unfavorably by the environmental factors operating in the life of each individual. These factors may include diet, toxemia, mental hygiene, work, etc. Age forty may, therefore, be regarded as roughly representing the meridian of life, after which the senescent process in varying degrees makes itself obvious through one or more of the vital organs—heart, arteries, kidneys—or collectively the cardio-vascular-renal system. Only such a conception gives us a broad enough view to successfully guide and influence the individual clinical case, or to arrive at an adequate basis for underwriting action.

From the underwriting and statistical point of view, it is essential that we consider individual impairments in their relation to the probable longevity of the applicant and not necessarily as diseases which have some characteristic course. If, as we formerly did, we label a systolic murmur at the apex as mitral insufficiency, and then view it as portrayed under the textbook description, with its narrow definition of etiology, pathology, prognosis, etc., we miss the real significance of the murmur or of its relation to longevity. So, if we label albuminuria as nephritis, and attempt to fit it to a certain section of nephritic terminology, I am afraid we miss both the clinical significance of the condition and the underwriting effect on longevity. Clinical medicine has an important lesson yet to learn from the underwriting method of attaching a definite prognostic significance to individual credits and impairments, but the lesson will be retarded by the emphasis which has been laid on specific diagnosis. We have been schooled to the effort to classify each case under a disease diagnosis to such an extent that individual credits and impair-

ments merge their real significance into the largely unreal prognostic significance of an arbitrary disease complex classification.

Perhaps nothing better indicates the contradiction into which we have been led by the error of specific diagnosis, and consequent specific medication, than the various waves of therapeutic enthusiasm—often almost indistinguishable from quackery, which have been directed at these degenerative processes. Within our memory, the water cures, with enormous volumes of fluid; then the reaction, and papers written to show how much injury excessive fluid entails. Then auto-intoxication from the large intestine and the dangers of constipation. Now, Alvarez, McCalla, Zimmerman (11) show that in men constipation has absolutely no effect on blood pressure; in women, some connection between constipation and a slightly *lowered* mean blood pressure. Various specific drugs, iodine, etc., electric-thermo- and photo-therapy, the infection theory and the search for hidden foci—gums, tonsils, teeth, appendix, gall bladder—endocrine therapy, psychotherapy—and yet no general favorable results shown, but rather a steadily increasing mortality rate from these conditions.

Unfortunately, a great deal of the value of the periodic health audit has been lost because it has become, in practice, not a guide to health, but a search for disease—for Bright's disease, for heart disease, for arteriosclerosis, etc. We can much more effectually grasp the significance of an individual impairment and attempt to correct its cause if we consider it individually or in its natural relation to other impairments, than if we insist upon coercing it into the restrictions of a forced specific diagnosis. Much of the stimulus

in this direction has come from the optimistic views of men like Irving Fisher, who seems to think of the life process as a perpetual form of energy, subject only to interruption by disease, and that if accident and disease could be eliminated, the span of human life would be indefinitely prolonged. This attitude is not far removed from the visionary search of Ponce de Leon. The eradication of disease does not retard the infant from developing into youth, the youth into maturity, the adult into old age. We have no good evidence that the normal span of human life has been increased during the history of the race. It is true that years have been added to the average life expectancy, but, as Cohn (12) expresses a fact well known to statisticians, the duration of life has not been extended—only the attainment of its natural length has been rendered possible. He calls attention to the fact that increased life expectancy is a mathematical phenomenon, and not a biological one. For example, if automobile accidents could be stopped, American life expectancy would be increased about two months, but the natural duration of human life is not determined by a mechanical invention.

Dr. Osler was indignantly criticised for a casual remark indicating that human beings inevitably aged and wore out. The men who bragged of being as strong and young at sixty as they were at twenty resented a scientist exploding the bubble of their personal vanity. We are inevitably aging every day and hour. Is it wise to deny the main fact of life and try to believe instead that we are only unfortunate finally in being the victim of some disease? Longevity is often viewed as narrowly as morality. Orthodox religion has disregarded the scientific facts of morality

and held everyone equally culpable for infractions of an arbitrary code, when we know that hereditary and environmental factors often control conduct irrespective of the individual. So medicine has disregarded the laws of longevity and over-emphasized the influence of disease in the attainment of the arbitrary standards of desirable longevity. As a matter of fact, it is permissible to question whether great longevity is really desirable, that is, beyond, say the period of natural vigor of mind and body.

Would we not be viewing the problem of the degenerative diseases more truly and more helpfully if we assessed an actual debit or credit for the various factors which modify normal longevity, rather than attempt to translate them into a specific disease complex with its corollary of an over-emphasized therapeutic indication? In other words, the numerical rating method would be applied clinically similarly to the method we are beginning to use in underwriting. Instead of waiting until a man developed "Bright's disease" or "hypertensive heart disease," say at fifty, or a certain advanced symptom complex that meets the variable standards set by different physicians as corresponding to a well-defined disease, the man would be observed year by year and a chart kept of various signs and symptoms which might indicate an abnormal advance of the degenerative process in one or more organs. Thus at forty-five the first trace of albumin (.02 or .03); at forty-eight beginning hypertension (140/90); at fifty the first stage of cardiac hypertrophy; at fifty-five the first noticeable thickening or tortuousity of retinal vessels, etc. For each of these impairments we could assess a fairly definite debit

which is translatable into years of decreased expectancy.

In our underwriting consideration of applicants past forty, we, of course, wish to discover and assess specific diseases such as cancer, diabetes, tuberculosis, anemia, the chronic pyogenic infections such as cholecystitis, appendicitis, peptic ulcer, pyonephrosis, cystitis, etc., syphilis, but there remains a large group in which the only impairment is one or more signs or symptoms of chronic degenerative change in the vital organs—heart, arteries, kidneys. Just what the exact causal relationship of these various signs and symptoms is, is as yet far from clear, but we have made an excellent beginning in assessing the influence of some of them on longevity—especially overweight and increased arterial tension. In these our numerical standards are very exact—and, while to a less definite degree, still some advance has been made in assessing others—pulse rate, intermittency, degrees of albuminuria, cylindruria, concentration, renal sufficiency, family history, arterial thickening, heart sounds and heart size. The point I want to make is that a truer clinical and underwriting evaluation of the individual is obtained if we consider all the available data indicative of the probable endurance of the cardio-vascular-renal system, and view the progress of the degenerative changes towards the eventual termination as a widespread process rather than hastily force the conception into a specific and partial diagnosis.

Mr. A, capitalist, age fifty-five, has .03 per cent albumin intermittently, specific gravity averaging 1.014, renal sufficiency three-fourths normal, his blood pressure is 160 systolic, 98 diastolic; his heart size by X-ray is 20 per cent above normal. Has he a definite

disease? He is in vigorous health, conducts a large corporation, plays golf, enjoys life thoroughly. Is he not merely showing an accelerated degenerative process accompanied by certain common signs and symptoms, which though their interrelationships are not thoroughly understood, may be accepted as fairly accurate indications of the progress of the condition? We may assess him so much for each discoverable impairment and obtain a reasonably accurate estimate of the decrease in his probable life expectancy.

In this connection I want to call special attention to the important factor which we are now largely neglecting—heart size. At present our underwriting standards of heart size are confined almost altogether to a grossly inaccurate estimate of normal, moderate, or great enlargement, determined by observation, percussion, and auscultation. I think we need to have called to our attention—first, that of all the indications of chronic degenerative process, the most constant and most important is cardiac hypertrophy and dilatation; second, that heart size is now by the X-ray plate, the fluoroscope, and especially the orthodiascope, susceptible to accurate measurement. When we realize this fully I believe we shall utilize the means at our command for obtaining this essential information. It will be objected that an X-ray is not practical in an insurance examination. Let us remember that the same objection was raised in turn to urinalysis, to the sphygmomanometer, to blood sugar, etc. If radiology really gives us information which will permit more intelligent and more profitable selection, we will sooner or later utilize it. If Dublin's estimate that one in every five of the population living at age ten will die of heart disease, it is probable that one-half of the

population at age twenty will die directly of cardio-vascular-renal disease. If two million people are now suffering from recognizable organic heart disease, there must be over four million who are suffering from cardio-vascular-renal disease in established form. The death rate from organic heart disease at ages forty-five to fifty-five is ten times that at the decades prior to thirty-five, and as arterial and renal impairments are relatively much more common at the older ages, the incidence of cardio-vascular-renal conditions past forty-five is evident. The importance clinically of recognizing cardiac hypertrophy and dilatation is emphasized by some recent expressions, as follows:

Eyster (13) says:

"Determination of the size and contour of the organ represents the most important single procedure in cardiac diagnosis. If we are in a position to detect with perfect accuracy the departure from the normal in this respect, we could, with our present knowledge of cardio-dynamics, determine the presence and estimate the extent of every cardiac abnormality except those specifically affecting the autonomic and conductive system.

"The most generally neglected of the aids to cardiac diagnosis is the X-ray.

"* * * a determination of that which means more than any one single observation in estimating the amount of myocardial reserve, namely, enlargement of the heart.

"All recent experimental work tends to indicate that the real injury that results to a heart in organic heart disease is the result of stretching the muscle. It is this, probably, which is the direct cause of the hypertrophy. All of us are familiar with young subjects with multiple valve lesions who have perfectly good compensation and are physically active.

The hypertrophic heart undergoes degeneration earlier than the normal heart."

Sprague and White (14) say:

"The first demonstrable effect of either lesion (mitral insufficiency and stenosis) upon the heart is brought to bear on the left auricle, and prominence of the shadow in this region can be seen in all but the very earliest cases.

"In mitral stenosis the left auricle becomes enlarged by hypertrophy and dilatation, and the stasis in the lungs leads to further enlargement of the right ventricle. * * * Mitral regurgitation is marked by the changes in the left ventricle. * * * The early changes in heart size, particularly in the region of the upper left border, are valuable evidence of the organic nature of the murmur, while enlargement of the left ventricle may be found as the lesion progresses. * * * Mitral regurgitation causes a general enlargement of the heart, as contrasted with the right ventricular and left auricular enlargement due to mitral stenosis."

Stroud (15):

"Certainly murmurs are of importance and their depreciation is being overdone by many clinicians, but an attempt should be made to seek the middle ground and give them their relative importance as aids in estimating that which most of all we wish to know —the myocardial reserve. * * * A systolic murmur at the apex or base, with only questionable cardiac enlargement, may be of great importance in elderly people.

"The truest estimate of the extent of the encroachment upon the myocardial reserve is to be gained from a determination of the extent of the enlargement of the heart. This dictum of the modern cardiologist is the one least well understood and least readily accepted, perhaps because of the difficulty of determining

the extent of enlargement in borderline cases. Nevertheless, any enlargement of the heart which is demonstrable means damage to a greater or lesser degree to the myocardium, and a loss of myocardial reserve."

Fred M. Smith (16):

"The progression of the disease was indicated by an increase in the size of the heart."

Lambert (17), speaking of the very frequent and important lesion of coronary arterial disease, says:

"In a majority of patients there are hypertension and an enlarged heart."

Fred J. Hodges, of the University of Wisconsin, in a personal letter, says:

"It is with considerable interest that I reply to your letter because I have long wondered at the failure of the insurance companies in general to make the use of modern diagnostic methods in heart diseases which would seem to be so logical. In my experience there have been many instances wherein the EKG or a heart size tracing would have at once ruled out as a poor risk, individuals who shortly became claims on the company."

Is this clinical sign of cardiac enlargement and dilatation of the aorta not of sufficient importance in underwriting to deserve our earnest consideration?

Competition in larger cases, especially the borderline type, is becoming increasingly keen. The company which uses the most definite and exact methods will be the one which can act most promptly, most liberally, and most profitably—all three essential factors in competitive salesmanship. The size of the heart is the most definite indication we have of cardiovascular-renal integrity. The blood pressure may vary within wide limits; albumin may be transitory

and due to physiological causes; but an enlargement of heart or aorta cannot be considered negligible. A competent X-ray opinion is now readily obtainable in any town of 10,000 or over, and would, therefore, be available for all larger cases, say $20,000 and over, and usually for a moderate fee. It is certainly of more value than the alternate examination now required in larger cases, and which we all know to be largely a formality.

An informed agency force and general public will gradually bring more and more of the larger cases for examination, either to the home office or to fully equipped clinics, where any borderline impairment can be promptly evaluated and the case declined or an offer made. The crude methods which formerly passed without criticism will be questioned, especially by the agency force, because it will cost them business to which they have a right. The medical department at the home office should be in a position to do as good and as thorough diagnostic work as a modern clinic, as far as underwriting requirements demand. It necessarily sets a standard for the work expected of the field examiners. The day may not be far distant when we shall be able to obtain as competent an opinion on cardiac hypertrophy and dilatation at our home offices as we now can of the results of observation, auscultation, the use of the sphygmomanometer, and of urinalysis. Through the courtesy of the Kelly-Koett Manufacturing Company and the Western Electric Company, I have the opportunity of showing you today the use of the orthodiascope and the amplifying stethoscope on several cardio-vascular cases.

The orthodiascope has been known in Germany for nearly twenty years, being first devised by Professor

Moritz, and is widely used in the clinics of the continent. Abroad, it is recognized generally as being the most accurate instrument for measuring the size and shape of the heart. The accuracy is obtained through fluoroscopy, with the tube on a movable frame. This enables the operator always to have the central rays from the tube behind the point under examination, thus eliminating distortion due to diverging rays registering on a plate at a six or seven-foot distance. There is a device attached for a graphic registration, by means of a stylus, of the heart outline, so that a permanent record is obtained. (Four orthodiagrams are appended.)

Normal standards in vogue are those supplied by Dietlen, following an extensive survey of German soldiers in health. American standards have been worked out by Dr. Fred J. Hodges. There are tables of normal standards for each sex based on comparative ages, weights, heights, and chest measurements, the latter comparison being the most convenient in practice. Diagnosis of valvular diseases, beginning aneurisms, arteriosclerosis of the aorta, hypertension, and cardiac enlargement may be made with reasonable accuracy from the orthodiagram alone. In measuring cardiac enlargement, an easy method is to incorporate on the graph the outline of the bony thorax at the level of the diaphragm. The transverse measurement of the heart, taken from the widest portion of the right heart to the widest shadow at the apex, should total less than fifty per cent of the transverse chest measurment at the diaphragm to fall within normal limits. In the normal heart, there is a variation from the mean in the transverse cardiac measurements of the magnitude of approximately 0.5 cm.

Along with an accurate estimation of arterial ten-

sion and a percentage estimation of albumin, I believe a percentage knowledge of cardiac enlargement will give us a third important additional piece of evidence in regard to cardio-vascular-renal integrity, and one upon which to base action either for standard insurance or for more accurately rated substandard coverage.

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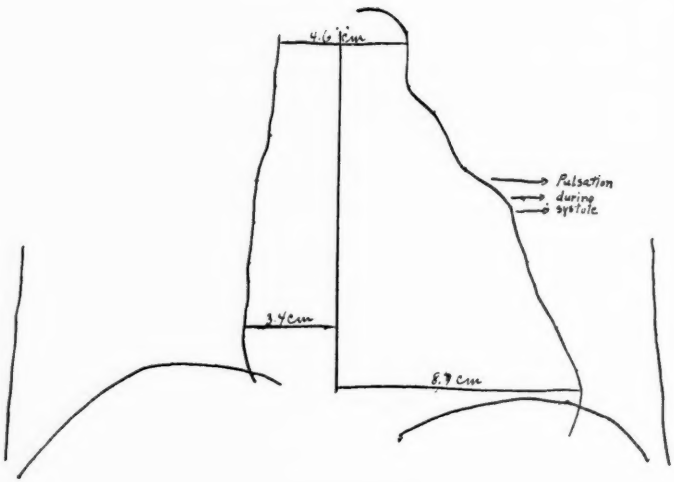
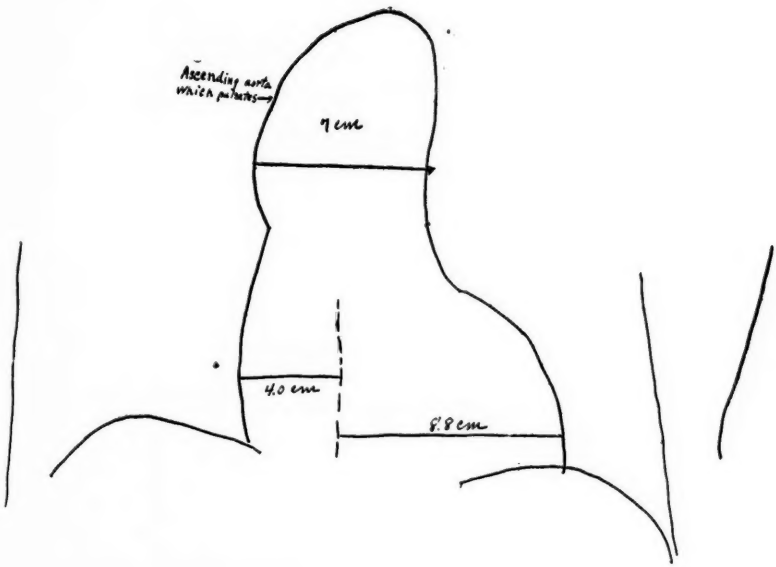


Mrs. A. F. Age 40. 3/28/27. Frequent quinsy. No rheumatic fever. No chorea. Short breath on moderate exertion. No decompensation. Cyanotic finger tips. Presystolic murmur at apex. Diagnosis: Mitral stenosis.

Mean average normal	11.7 cm.
Transverse heart	12.1 cm.
Arch	4.6 cm.
Enlargement of conus.	
Enlargement region left auricle.	
Mitral stenosis outline.	
Very little, if any, dilatation.	



Mr. E. W. Age 39. 3/22/27. "Rheumatism" at age 15. Vertigo, dyspnea on exertion for one year. Edema of ankle 6 mos. Loud diastolic murmur, left sternum. Blood pressure 196/96. Arteriosclerosis of retinal vessels in early stage. Wassermann four times negative.

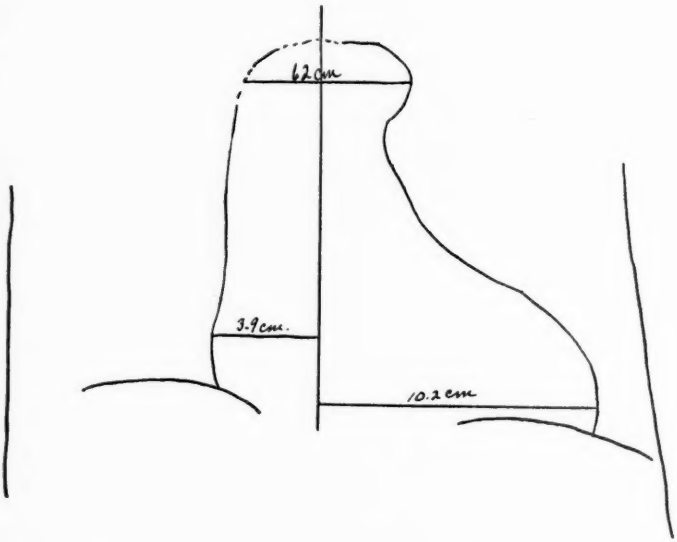
Transverse chest	26.0 cm.
Transverse heart	12.8 cm.
Arch	7.0 cm.

Height 66¾". Weight 138 lbs.

Aneurism ascending aorta (probably non-luetic).

Slight cardiac dilatation on basis of weight and height.

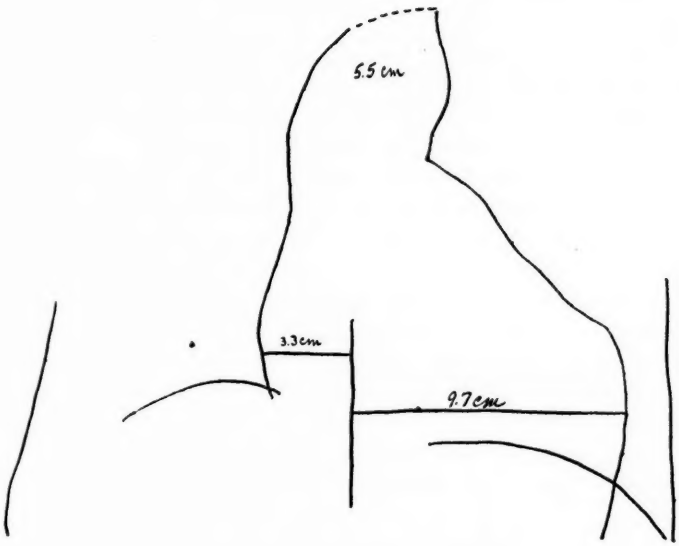
Aortic regurgitation (etiology rheumatic or arteriosclerotic).



Mrs. A. E. Age 50. 7/13/27.
Hypertension 8 years' duration.
234/140 in March, 1923.
250/150 in July, 1927.
Just beginning cardiac failure.

Transverse chest	23.6 cm.
Transverse heart	14.1 cm.
Arch	6.2 cm.

Approximately 19% increase in transverse over normal.
Arteriosclerosis aortic knob.
Enlargement left ventricle with slight dilatation.



Mrs. A. Z. Age 43. 5/6/27.
No history rheumatic fever, chorea or syphilis. One miscarriage. Five living children. Loud systolic and faint diastolic murmurs over aortic area and left sternal border. Blood pressure 140/50. Wassermann negative.

Transverse chest 23.0 cm.
Transverse heart 13.0 cm.
Enlargement left ventricle.
Aortic stenosis and regurgitation.

Dr. Beckett—I will ask Dr. Grosvenor to open the discussion on the paper.

Dr. Grosvenor—Having attempted occasionally to construct papers based on statistical information, it is a most distinct pleasure to have the opportunity of reading Dr. Cook's paper.

Although statistical information may in a considerable measure be our daily and routine guide, it is necessary that we keep abreast with clinical advances in order to correlate our statistical studies.

Cardio-vascular-renal disease may have practically a common termination, but is of varied etiology, and accompanied by varied symptoms. This being the case, we must take cognizance of varied symptoms, and although our terminology may be altered from time to time, yet the processes which make for impaired symptoms have been and are being recognized and taken into account. Even so the more intelligent the basis of action, the more correct the result. To accomplish such results without terms of designation, is too much to expect of medical science as at present constituted. "A rose by another name smells as sweet."

It may be well to consider chronic disease as of a general senescent or presenescent change, although the character of tissue change is not similar in all types. Ultimate facts as to the longevity of the individual are equivalent and groups of individuals construct classes. It behooves us to keep abreast of clinical advancement in medicine, in order that we may know the trend of advancement in the understanding of disease processes, as established at the time of our activity. The clinician and the medical underwriter with his statistical events materially aid each other.

Referring to the various methods of determining the

heart size, etc., I think perhaps Dr. Cook has not sufficiently emphasized the value of the fluoroscopic study of the aorta, because of the various angles from which it may be seen by this method, and the fact that plaques are often seen through this means, while they are often missed, during the study of the radiogram. The orthodiascope and the telorentogram are new only in the sense that we, as life insurance underwriters, have not sufficiently availed ourselves of them. Their value to the proper studying of risks is unquestionable. Their practicability may be questioned only on the grounds of expediency, and that is only a hurdle, not a definite obstacle.

Beginning with their use in the larger amounts where the employment of special means is admittedly justifiable, and all concerned seemed to become agreeable to employment of additional means of precision and to no longer regard them as obstacles. This is apparent in the history of medical underwriting.

Dr. Cook's orthodiascopic tracings show marked abnormality of cardiac contour but the original physical findings in each instance were such as to place the individual beyond the pale of insurability. I wish that he might have been able to show us a trace of a borderline case in which the tracing showed sufficient abnormality to in itself effect the decision.

If I may have the author's permission, I would like to add to his list of references as worthy of study in the same connection a work by Dr. C. R. Bardeen, as put out in the U. S. Army Medical Manual.

Dr. Beckett—Dr. Patton.

Dr. Patton—Insurance experience, to be of real value, requires a sufficient amount or volume and

enough years of exposure to furnish data from which definite averages can be drawn.

Dr. Cook has presented so well the arguments along the lines of his paper that little more is left to be said, and he also leaves no room for doubt in our minds as to the importance cardio-vascular-renal degeneration plays in the consideration of life insurance applicants.

There were 16,283 death claims in our ordinary business in 1926, male and female cases combined. Organic heart diseases accounted for 2,816 or 17.3%, apoplexy for 1,081 or 6.6% and kidney diseases for 1,451 or 8.9%. The total from these cardio-vascular-renal causes was 5,348 or 32.8%. Thus, it is readily seen how important these conditions are for us.

We have kept the records since 1921 of a number of impairments and though these cases, carried to the anniversary of the policies in 1926, gave us an average duration between two and three years, therefore too short a period for real insurance experience; yet we believe that we can learn something of value from these studies now and that a few years more will add greatly to these values and give us results that will be well worth while.

Pulse abnormalities combined (rapid, slow, intermittent or irregular) present at time of examination or history of having been found previously in 5,754 cases gave us 57 death or 84% of the expected per the American Men's Table. The average duration was 2.3 years, but the group was too small to subdivide as to the type of abnormal pulse recorded. The deaths from organic heart diseases were 18 or 31% of the 57 total, whereas our general ordinary claim experience of 17.3% would have given us about 10

deaths. Additional to these there were 3 cases of apoplexy and 2 of nephritis, making a cardio-vascular-renal total of 23 or 40%, which is greater than our general claim mortality of 32.8%.

Organic heart murmurs, mostly mitral regurgitant, some with slight or not more than moderate hypertrophy, have given us the following results:

Murmurs present at time of examination in 4,580 cases gave 74 deaths or 147% of the expected. Fortunately for us, a small part only of these cases, was insured at standard rates and the whole group was well covered by the ratings we had imposed. The average duration was 2.36 years. Organic heart diseases caused 35 or 47.3%, other circulatory conditions 4 and renal troubles 3, or the total cardio-vascular-renal deaths were 42 or 56.7%.

With murmurs previously reported but not found at our examination in 5,129 cases give 42 deaths or 68% of the expected. We all have cases repeatedly that have both X and Q heart murmur records. Why we had such a favorable experience with cases that did not show murmurs at the time of our examination, although it had been previously reported, I do not know. Those same cases examined later by us or other companies would undoubtedly have the murmurs found again. Organic heart diseases caused 11 or 26.2%, other circulatory conditions 4 and renal 1, or the total cardio-vascular-renal deaths were 16 or 37.8%.

Hypertrophy, slight or not more than moderate, and without murmurs, in 2,005 cases gave us 36 deaths or 138% of the expected, and here again our ratings imposed took care of our exposure. The average duration was 2.67 years. Organic heart diseases caused

19 or 52.7%, other circulatory conditions 2 and renal 3, or the total cardio-vascular-renal deaths were 24 or 66.6%.

Hypertrophy not found, though previously reported, in 1,813 cases gave us 25 deaths or 114% of the expected, with an average exposure of 2.33 years. Organic heart diseases caused 7 or 28.0%, other circulatory conditions 1 and renal 1, or a total cardio-vascular-renal deaths of 9 or 36.0%.

Albumin found present in 5,519 cases, to whom we issued rated policies, gave us 37 deaths or 73% of the expected with an average exposure of 2.24 years. Organic heart diseases caused 8 or 21.6%, other circulatory conditions 3 or 8.0% and renal diseases 5 or 13.5%, or a total cardio-vascular-renal deaths of 16 or 43.2%.

Albumin not found though previously reported present in 1,483 cases, to whom we issued rated policies, gave us 19 deaths or 104% of the expected with an average exposure of 2 years. Organic heart disease caused 5 or 26.3%, other circulatory conditions 2 and renal 2, or a total cardio-vascular-renal deaths of 9 or 47.3%.

Various home offices have developed their methods, numerical or otherwise, with their appropriate outlines for the guidance of their medical and lay approvers in the care of their cases; yet we agree with Dr. Cook that a routine use of these instructions will quite frequently work an injustice upon an applicant or the company. These rules should be broken by medical approvers only and this authority should be delegated to those medical approvers whose judgment had been proven to the satisfaction of their

medical director responsible for their work. The rules for our lay approvers in many places order reference to medical approvers, and these in turn are told to refer doubtful cases to the older or more experienced members of the home office medical staff.

The blood pressure work of the insurance medical men has, in my opinion, done more for clinical medicine than the clinicians' blood pressure work has for life insurance medicine; yet both are more valuable because of the results of each other.

These conditions cause so many deaths in life insurance and public health records that their importance cannot be minimized in any way, and, as Dr. Cook has also said, the disability features in life insurance have added greatly to the importance of cardio-vascular-renal possibilities.

Most insurance companies have found in recent years that organic heart disease leads as a cause of death and this is also shown in the United States Census reports.

The ordinary mortality records for our company showing the cardio-vascular-renal group of organic heart disease, kidney disease, apoplexy and paralysis in males and females gave the following:

	1911	1917	1922	1923	1924	1925	1926
Total	4413	7585	11270	12868	13515	14848	16283
C. V. R.	990	1945	3398	3887	4418	4836	5510
%	22.4	25.6	30.1	30.2	32.7	32.6	33.8
Organic heart	264	815	1657	1904	2024	2427	2816
%	6.	10.7	14.7	14.8	15.0	16.3	17.3
Kidney	451	711	883	1030	1256	1238	1451
%	10.2	9.4	7.8	8.0	9.3	8.3	8.9

This illustrates the marked increase in this group and especially in the organic heart disease portion of it and this agrees with Dr. Cook's comment on 100,000

deaths showing organic heart as causing the greatest number.

The development of clinical medicine through the phases of arteriosclerosis, Bright's disease, organic heart, myocardial conditions and hypertension is well known to us all.

Based upon life insurance results all these physical or diseased conditions should be grouped together in the estimation of the insurability of an applicant. We must judge from our own experience with our examiners just which condition or sign they are most likely to emphasize, and then take action accordingly. Admitting the importance of urinary findings, yet, uncombined with circulatory findings or history, they are of much less importance; while low specific gravity, albumin, casts, etc., in conjunction with valvular, myocardial, hypertrophy or hypertension findings are of great importance in reaching a decision upon an applicant's probable longevity. The condition of the myocardium is perhaps the most important single element for us in life insurance. The methods or ways to determine this have received the attention of clinical and insurance medical men for many years and they still fill the center of the stage for us. We must not forget, notwithstanding the statements of eminent teachers in our medical centers, that post-mortem failures to find signs of valvular lesions should not override clinical or examination findings and diagnoses. This is proven by insurance examination findings of albuminuria, glycosuria, hypertension, hypertrophy or valvular lesions of the heart, etc., with death rates in such groups higher than the normal. Post-mortem failure to find physical changes in the heart muscle or valve does not mean that organ was functioning normally when the individual was alive.

Mortality statistics with the increased number and percentage of deaths from cardio-vascular-renal causes show their importance in life insurance and that their rate is highest in the 4th and 5th decades. The condition is usually diagnosed or named after the most prominent cardio-vascular-renal symptom noted.

The most common signs are cardiac hypertrophy, hypertension, breathlessness, pain in chest, abnormal pulse, albuminuria, low specific gravity, etc. The general senescent changes of the individual after age 40 undoubtedly adds to the mortality.

Life insurance cannot limit consideration of physical impairments reported by its examiners to the clinical or text-book description, but must also consider the effect upon the individual as a whole and his life expectancy or the prognosis, and as Dr. Cook has so well said, this applies equally as well to the therapeutical fads or practices.

The outlined ideal system of annual physical examinations and the assessment of ratings depending upon the changes from the normal would be of especial value to us in cardio-vascular-renal conditions after age 40 had been attained.

The exactness with which we can get the heart's size and the condition of the heart muscle is the chief concern in our office, as we consider that of the greatest importance in cardio-vascular-renal cases. Though electro-cardiograms, X-ray and other records are much more readily obtained than formerly, yet they are difficult to get in many cases and we must depend upon other tests many times. We realize that numerous heart and lung reports based upon physical examinations give incomplete, and at times

inaccurate information for us to use to decide on the degree of abnormality present. We still believe that most examiners can and do report enough of these impairments in a large majority of cases to warrant our faith in their skill, and to enable us on the average to judge the acceptability of the risk. Certainly it is not good for the training of our examiners for us to broadcast the opinion that there is no dependence to be placed in the results of their inspection, palpation, percussion and auscultation, and that all questionable cases must have orthodiagrams, etc.

I desire to repeat in closing, that the cardio-vascular-renal deaths in our general mortality are a matter for serious consideration by all of us, and this is emphasized by the increased percentage of these deaths in the groups of cases that have a history of any of these diseases or show signs of them at the time of their examination. The condition of the myocardium is the essential factor for us to determine.

Mr. Beckett—Dr. Gordon Wilson of the Maryland Life will now discuss this paper.

Dr. Wilson—I want to say that I had just as much enjoyment in reading Dr. Cook's paper as I had in reading Dr. Johann's paper, which is saying a good deal.

Dr. Cook's paper makes clear a mistake that we medical directors are constantly making; namely, to diagnose a diseased condition in one organ only on the facts presented to us. This one mistake is constantly made by practitioners as well, and they have one big advantage that we lack, namely, the co-operation of the patient as to symptoms, which are minimized to the insurance examiner. Dr. James MacKenzie appreciated so strongly the value of symptoms

as showing the beginning of disease that he gave up a large consultation practice in London in order to found an institute in a small Scotch city, where symptoms could be studied.

A most important thing to constantly bear in mind is that in all chronic diseases, although primarily involving only one organ, eventually all organs are affected, and unfortunately the degree to which they are affected does not show up clearly by our methods of examination. What have we as medical directors to look to for some idea of the degenerative diseases? The urine, the blood pressure, the heart and finally, not the least important, the degree of emphysema, and I can't emphasize too strongly that emphysema is an important indication of degenerative disease, which can be accurately measured by the amount of chest expansion, and when the total chest expansion is three inches or less we can be absolutely sure that the applicant has emphysema, and must remember that this emphysema will mask an enlarged heart. It is in these cases of emphysema that the orthodiascope is of immense help in showing an enlarged heart, which would not be suspected by the ordinary method of examining its size by percussion. There has been a recent improvement in making stereoscopic X-ray films of the lungs that allows the films being made at a distance of seven feet, and we thus are able to get an accurate record of the size of the heart when we are making films of the lungs. In the Diagnostic Clinic of the Veterans' Bureau in Washington, we have for some months past been making such films as a routine in every case, and have found that they are excellent for the study of the lungs, and inci-

dentally have given us in each case a fairly accurate record of the size of the heart.

In the use of the orthodiascope one error is likely to arise unless we are "on guard," namely, that in stout individuals who are well muscled, the diaphragm, with normal respiration, is apt to be high, and thus tilts the heart, allowing the apex to be well out towards the anterior axiliary line, thus increasing the transverse diameter of the heart shadow, and suggesting cardiac enlargement when there is none. With such a patient or applicant we should have them take a deep inspiration and hold it, and at once the apex will come to its normal position and there will be not even an apparent cardiac enlargement. During the past week we have found three such cases in the Diagnostic Clinic, where on ordinary respiration the apex and cardiac dullness were outside the midclavicular line, but on deep inspiration came in a full inch to normal position.

There is one point in Dr. Cook's paper that I think is of great importance, and that is that we should assess a value to these signs of cardiac, renal or vascular disease, not in terms of these diseases, but in terms of "degenerative disease," and we would thus get a clear idea of the condition with which we are dealing, not a disease of the heart nor a disease of the kidneys nor of the arteries, but of all these organs combined.

Dr. Beckett—This paper is now open for discussion. We will be glad to hear from anyone else. Dr. Cook, will you close the discussion, please?

Dr. Cook—My experience in meetings of this character has been that a discussion of a paper is very frequently more instructive and more interesting than

the paper itself, and I think it certainly holds in this case. I appreciate very much the discussion and enjoyed it.

There was one point that came up in our consideration of installing the X-ray, and that was the practibility of it from an expense point of view. We have to submit our budget to our executive officers, and an X-ray machine properly equipped and with an orthodiascope attachment costs in the neighborhood of $4,000—and $4,000 is quite an outlay particularly for a small company—so we did not install one as soon as we began to use the X-ray. Not long ago, I had estimates made for me of the amount we were expending for X-rays in Minneapolis in connection with our employees, service to employees, both on entrance examinations and later in regard to their health service, and for policyholders that we see at the home office in connection with our health service and in connection with new applicants for insurance, and at the present time we are spending about $700 or $800 a year. We are a company that is writing fifty millions of business a year, paid for, and have about 175 to 200 employees, a small company. The interest on $4,000 is only $240 and I felt, and we all agreed, that the most expensive thing we were doing was not to install an X-ray machine in the home office, because we could not only save the difference between what we were spending and what it would cost us to do it ourselves, but we could extend the field very much. We hesitate now to get an X-ray in many cases on account of the five or ten dollars it would cost for the picture. If we had our own machine, it would only cost us fifty cents or so to get an X-ray and we would certainly extend our use of it, so that I believe that the installa-

tion of an X-ray machine at $4,000 is going to be an economy for us rather than an expense. I thank you.

Dr. Beckett—The next paper, "The Doctor and Insurance," by Dr. Harry W. Dingman of the Continental Assurance Company of Chicago, will be read by title. We regret that because of illness, Dr. Dingman is unable to be with us; but I am pleased to state that he is greatly improved and it is expected that soon he will have entirely recovered.

THE DOCTOR AND INSURANCE

by H. W. Dingman, M. D.

Medical Director, Continental Assurance Company

It seems to me that a physician should particularly study prognostics (Hippocrates).

Outstandingly idealistic of all vocations as is the practice of medicine, it is not strange to learn the close interrelationship that physicians have had in the upbuilding of life insurance, pre-eminently idealistic of all commercial institutions.

And why not? Personal insurance relieves distress consequent upon death and disability. So also do physicians.

The doctor has made his impress on insurance in three ways:

A—Study of general economic matters.
B—Research into medical problems.
C—Development of prognostic medicine.

The earliest life insurance was property protection. A mariner assured the success of a voyage by insuring the ship and the cargo—and himself. As time passed protection was offered for the term of one year, as William Gibbons knew on a June day in 1583 when he paid an 8 per cent premium. It cost 16 underwriters £383-6-8 when he died on a May day in 1584.

Presumptive length of life was the problem and the answer was sought in census data. The first numbering of the people was of the Israelites by Moses. Solon is said to have made a registration of the Greeks about 650 B. C. The Romans had 75 census

reports in 600 years before Christ. It was these enumerations that permitted Ulpian, the Roman Jurist, to devise the earliest table of mortality of which we have record. The first complete census in modern times was made in Sweden in 1751 (2).

The year 1517 appears to have inaugurated registration of births and deaths, in England (3). In 1583 Thomas Cromwell (4) issued injunctions on behalf of Henry VIII that all parishes in England should keep a weekly record of baptisms, marriages and burials "for the advancement of the trewe honor of Almighty God, encrease of vertu and discharge of the kynges majestie." Thomas Short (5), a physician, was able to find records of at least two parishes in the year 1538.

However, it was necessary for Queen Elizabeth in 1594 to direct anew that weekly compilations be kept with certification of what probable disease each individual died.

It was 1662 before the first serious attempt was made to classify vital statistics, extract their secrets, and demonstrate their value in national life. Whether Sir William Petty, M. D., wrote the "Natural and Political Observations upon the Bills of Mortality" that appeared under the authorship of Captain John Graunt, will never be known. Edmund Halley and Bishop Burnet and others believed that he did. He himself made no such claim. Petty and Graunt were the closest of friends and, possibly, should be regarded co-authors (Fitzmaurice) (6).

As keen a mathematician as he was a physician, Sir William's many writings on the Dublin-bills of mortality, on the economic cost of deaths from plague, and kindred topics of national health, represent the

association of actuarial and medical minds that has meant so much for insurance.

Undoubtedly, it was medical opinion and vital statistics that influenced such life assurance as was being written at that time. It was an era of individual judgment. For instance, when the Amicable Society was formed in 1705, proposers (applicants) appeared personally before the Court of Directors who asked such questions as they pleased before pronouncing their opinions seriatim as to the eligibility of the proposed insurers.

It was 1737 when first was delegated to others the responsibility of selection of risks. "Persons resident more than 15 miles from London might be admitted on certificate from ministers and churchwardens as to health, age, business and occupation of proposed, and that he was a householder paying scot and lot" (7).

The Equitable Society of England inaugurated life insurance on a scientific basis in 1762. Cornelius Walford (8) has preserved the records that among the charter signers were several of the medical profession: the Honorable Coote Malesworth of Chichester, Doctor of Physic, F. R. S., John Sylvester of London, M. D., F. R. S., and Gowin Knight, Doctor of Physic. The early guidance of the company was largely in the hands of Dr. Richard Price, a Baptist minister, and his nephew William Morgan. Although the Equitable had no medical adviser formally appointed until Dr. Johnson in 1852, they were not without medical opinion even in the earliest days. That delightful gossiper, John Francis (9), has told us that William Morgan was originally educated for the medical profession, but "he showed so great a tabular aptitude

and evinced so much facility in the acquirement of mathematical knowledge that Dr. Price induced him to relinquish the profession of surgery for the situation of actuary to the Equitable."

Meanwhile vital statistics had been attracting more and more attention from many and many a scholar. Conrad Joachim Sprengell, M. D. (10), reviewed the records of 306,006 births and 217,942 burials in Germany during 1715-18. He learned of 84 persons who lived more than 91 years, 32 more than 100 years. Thomas Short, M. D. (5), studied all available vital statistics in England and Europe in order to ascertain healthfulness and longevity in various places. In particular he pondered, as did Dr. Price (11) contemporaneously, why city life was unhealthier than country.

J. Haygarth, M. D. (12), was making observations on the population and diseases of the Parish of Chester, and remarking on the comparative death rates in English and European cities. The commentaries of Dr. John Heysham (13) on the bills of mortality in Carlisle during 1779-87 made possible the Carlisle table of mortality published in 1815 by Joshua Milne (14). "His valuable registers of the diseases the deaths were occasioned by, have enabled me to show not only at what rate, but through what channels the stream of mortality flows at every age."

Mr. Milne has perpetuated some of Dr. Heysham's (15) writings. He lived when smallpox was a dreaded plague. He saw inoculation introduced, and superseded by vaccination. His remarks of the 1779 epidemic, when 300 nonvaccinated persons in Carlisle died of smallpox, illustrate neatly why the Equitable of England was imposing an extra premium on policy-

holders who had not had the disease. "During the same period several hundred were inoculated in the neighborhood of Carlisle, and it is a pleasing truth that not one of them died. * * * Yet so great is the prejudice against the salutary practice of inoculation amongst the vulgar, that few, very few, can be prevailed upon, either by promises, rewards, or entreaties, to submit to the operation. No wonder, that in rude, ignorant and barbarous times, superstitution hurried men into the grossest absurdities, when in a polished and enlightened age, in an age too, when the experience of full 20 years has clearly demonstrated the utility of inoculation, we see the bulk of mankind ready to sacrifice their children and all that is dear to them, to a foolish prejudice."

Vaccination eradicates smallpox. No better illustration could be cited of research in medicine that has benefited not only insurance, but mankind in general. It takes but a moment to name but a few epochal medical discoveries.

Edward Jenner (16) (1749-1823)—vaccination for smallpox (1798).

R. T. H. Laennec (17) (1781-1826)—auscultation in diagnosis (1818).

Robert Koch (18) (1843-1910)—tubercle bacillus (1882).

Frederich Loffler (19) (1852-1915)—diphtheria bacillus (1884).

Walter Reed (20) (1851-1902)—causation of yellow fever (1901).

William C. Gorgas (21) (1854-1920)—eradication of yellow fever (1905).

August von Wassermann (22) (1866-)—hemolytic diagnosis of syphilis (1906).

Frederick G. Banting (23) (1891-)—insulin relationship to diabetes (1922).

The special value that medicine could have to insurance was first suggested by Dr. Richard Price (24) in 1779. "I must take the liberty to remind the (Equitable) Society of the particular care necessary to prevent the intrusion of bad lives * * * it would not perhaps be amiss to appoint a medical assistant whose particular business shall be to inquire into the state of health of the persons who are offered to be assured."

But a half century was to pass before the custom was adopted. In 1811 The Scottish Widows' Fund and Life Assurance Society provided that "The directors shall have power to appoint one or more physician or surgeon in Edinburgh to judge of the state of health of entrants." G. C. Stenhouse (25) has told us how the proposer was required to obtain a physician to certify that "he hath never been afflicted with gout and asthma, or any other disease which tends to the shortening of life, and that I do believe his present state of health to be good, and his habits of life not such as to endanger his life."

In 1826 the family or personal physician was specified. In 1832 the society named a physician of their own choosing. It was 1835 when questions were first asked regarding the family history.

Medico-insurance literature is silent as to when first there was installation of a medical adviser as an insurance company officer. Very probably it was 1824 when Dr. George Pinckard (26) founded the Clerical,

Medical and General Life Assurance Society. Dr. Pinckard, being a medical man, conceived the idea that if his Board of Directors was comprised of eminent practitioners, intelligent appraisal could be made of physical impairments. Wherefore, as was related by his nephew (27), actuary of the company in 1851: "In forming the board of directors, he expressly provided that of the 17 gentlemen of whom it was composed, 8 at least should be members of the medical profession. In selection of these 8 directors special care was taken to secure men of eminence distinguished by their attention to some particular class of disease. Thus, one medical gentleman was selected who was considered particularly conversant with diseases of the lungs, another was chosen for his skill and experience in the ailments females are chiefly affected and the rest on similar grounds. By this arrangement whatever might be the complaint with which any applicant had been affected, there was always on the board a medical director peculiarly qualified by previous study and practice to estimate the increased risk caused by the complaint in question."

It was further provided that no assurance should be effected "Unless two at least of the directors present at the board shall be medical practitioners, or unless two at least of the directors who are medical practitioners shall have previously examined the person * * *."

Dr. Pinckard proved himself an organizer of marked ability. "We have never meet with a more clear, explicit, and carefully drawn Deed of Settlement," said Mr. Walford (26). His company thrives today in well-deserved prosperity.

Presumably it was 1824 when appeared a somewhat

remarkable provision in a prospectus of the Asylum Company that started operations in England a few months after the Clerical, Medical and General: "As it is frequently desirable, particularly in cases of pregnancy, to keep the parties in ignorance of an assurance upon their lives, females are not required to appear before a medical officer or a board of directors" (28).

The Eagle Insurance Company (29) issued a prospectus in 1826 speaking of the "physician of the office" and, again, the "medical officer of the institution." And it has already been mentioned that the Scottish Widows' Fund specified their own doctor in 1832.

In the United States a contributionship company formed in 1759, the Presbyterian Ministers' Fund, is still operating. The Episcopalians organized similarly in 1769 and again in 1797. Following 1794 the Insurance Company of North America wrote half a dozen life policies in as many years. The Pennsylvania Company for Insurance on Lives was organized in 1809, the Massachusetts Hospital Life Insurance Company in 1818, the New York Life and Trust (not the present New York Life) in 1830, the Baltimore Life in 1830, the New England Mutual in 1835 (but did not write business until 1843), and the Girard Life in 1836.

The Mutual Life of New York, 1842, is credited as the First American life insurance company actively soliciting business, and early records of the Mutual show the name of Minturn Post as medical director. Him we must regard as first of the medical men in American insurance history. Perhaps Cornelius R. Bogert, second. We see his name in 1845 in connec-

tion with the New York Life, at that time called the Nautilus.

That medical selection was by no means general before 1850. Benjamin F. Stevens (30) of the New England Mutual related most interestingly: "It was only when an applicant showed a weakness of some sort, an impure complexion, or something to create distrust, that the services of an examiner were required; and hundreds upon hundreds of our early members for a period of five years at least after our organization (1843) were insured simply upon the certificate of a friend who vouched for the applicant as being a man of good moral character, and to his best knowledge and belief free from disease. The applicant underwent the personal inspection of the president, and in his absence, my own. If there was an answer, however, to cause distrust, the applicant was sent to the office of Dr. George Hayward, an eminent surgeon in Boston."

As we review the last 100 years and observe how insurance medicine progressed steadily until it became customary for one physician to review the applicant, and another physician the application, one medical man commands triple honor. He blazed three pathways. He was the first physician to assume broad executive duties. He inaugurated insurance medicine on a rational basis. He started insurance of substandard lives on systematic lines. Undoubtedly to George Pinckard belongs the distinction of having contributed greatest from medicine to insurance.

But medicine, prognostic medicine, has likewise gained greatly from insurance statistical studies. Human lives are being appraised with the exactness of a science. Ponder the contributions in the last

quarter century on such subjects as albuminuria, asthma, blood pressure, glycosuria, heart impairments, malaria, peptic ulcer, pleurisy, rheumatism, syphilis, tuberculosis, weight.

No mention of physical impairments is complete that does not give credit to Oscar H. Rogers for his remarkable studies with the New York experience. He started in 1890 to study their rejected cases, then their death claims, and gradually evolved the well-known Numerical Method of assigning definite percentage values to each of the many factors affecting insurability of the individual. Undoubtedly to Dr. Rogers belongs the distinction of having contributed greatest from insurance to medicine.

And now the paradox.

Physicians have had a steadily increasing influence on insurance. Yet the present tendency is a diminishing one.

Why? And reasons three there seem to be:

Reason one: Insurability is determined by classifying, by merging the individual into the group. Each agency of selection must play its part in teamwork. But the doctor is not inclined toward teamwork, nor trained for it. Pridefully patriotic he proved in the Great War. But adaptability he found difficult. Psychologic tests of the (twenty) various officer groups, showed that "physicians ranked lower in mental alertness than any other group of the military class, except the supply train, dentists, and veterinarians." This the report of Brigadier-General Munson (31), M. C., U. S. A.

The doctor is an individualist by inclination and by training. His value was greatest when insurability

was assessed by individual judgment of individual applicants. And the trend of medicine is toward specialization, an intensive analysis of individual factors.

Reason two: Yesterday the chief problem of personal insurance was longevity. Today, disability. Life insurance and disability protection differ somewhat in the attitude of the policyholder. When a life policyholder claims he is dead, he is dead. Usually. When a disability policyholder claims he is sick, he is sick—or smoking on the back porch, or golfing in California.

It adds valuably to our lore of longevity likelihood, and our standards of sickness, when we study the careful checking of end results as done by the Mayo Clinic, the Trudeau Sanatorium, and others. Appraisal of physical and pathological factors cannot be overestimated. But, the presenting problem of the present is psychological. How many applicants that we accept will be surely sick, and how many subjectively sick?

Reason three: The examining doctor is not giving value received. He is not giving a five dollar report for a five dollar fee. His value in appraising insurability is (a) to get the story, (b) to ascertain the physical condition.

(a) To get the story he must ask the questions as an insurance doctor, rather than as a clerk. He must answer the unasked questions, chief of which is, "Is this report so complete that insurability can be determined?" He must realize that a good medical examiner must be a good cross-examiner.

Some applicants conceal information. Some mini-

mize it. Some distort it. The medical examiner should cross-examine. If an attorney misadvises a client because a witness misinforms him, how weak the explanation that he asked the questions and the witness bested him. A physician averages fully as intelligent as an attorney.

This is a very pertinent problem to companies who write non-cancellable health and accident insurance. And what is the present life policy disability clause but non-cancellable? The kind of applicants we have determines the kind of claimants we shall have. Physicians who realize this fundamental make themselves invaluable to insurance companies by picturing applicants as to character as well as to physique.

(b) To ascertain the physical condition he must know physical diagnosis. And if he did not get it in bed-side work he will not get it in correspondence courses. It was a vast experience in army medical schools and military hospitals that brought Nellis B. Foster (32) to the conclusion that, "Men who had not had some hospital experience, or who had not been interns in good hospitals, were usually inefficient, ignorant of common methods of diagnosis, and were not to be trusted with the seriously sick." They were found incapable of differentiating a mitral murmur from a diastolic, a pleural effusion from a pneumonia. "All my observations have gone to confirm me in the belief that the general practitioner is inefficient because he does not know how to examine patients."

And you please, permit a paraphrase: All my observations have gone to confirm me in the belief that the general practitioner is inefficient because he

does not (know how to) present a proper picture of insurability, which is the real reason for insurance being written non-medically by some companies for some amounts. It is an economic law to require value received. The general practitioner has shirked in service. And the efficient examiner has suffered for derelictions that are not his. The well-trained physician who likes insurance medicine and does it conscientiously can not be praised too highly.

Nor are insurance carriers blameless.

If we must anticipate claims for disability as well as claims for death, we should educate examiners regarding the added risks that we assume. Have we done so?

If we view insurance medicine as a specialty that has done much for mankind and must do more, we should formulate the practices and principles of prognostic medicine. Have we done so?

If we wish a good examiner to become better we should encourage examining efficiency more effectively. We could co-operate more among ourselves to concentrate upon the fewest doctors possible in a community so that insurance examining becomes more desirable as a speciality. Have we done so?

But—past problems have not prevented progress. Nor will present ones. The doctor's influence is a continuing one, and mutually desirable. One attribute we share in common. The physician is pre-eminent in ideals, and, of all commercial institutions, insurance is the most idealistic.

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Dr. Beckett—Dr. Archibald will present a paper on "Tuberculous Disease of Bones and Joints as Affecting Insurability."

TUBERCULOUS DISEASE OF BONES AND JOINTS AS AFFECTING INSURABILITY

by T. D. Archibald, M. D.

Medical Director, North American Life Insurance Company

In submitting this paper I feel that I owe the members of this Association an apology as the matter contained herein scarcely merits the caption; and yet with the progress which has been made in the early diagnosis and improved treatment, both surgical and general, of bone and joint tuberculosis, I believe the time has arrived when this Association can with all fairness to the companies represented and the risks who apply, take pause and review in a new light the selection of such cases.

I wish also to thank the members of the Association for their kindness in replying to my questionnaire, many with painstaking care. It is unnecessary to remark that the answers received were far from harmonious. Many companies declined all the risks in question, irrespective of any other conditions such as family history, age, weight, time elapsed, etc. Several companies treated these risks as definitely tuberculosed individuals irrespective of the site of lesion, and issued policies on this basis. Still others accepted such risks on a schedule of from one-half to two-thirds of the ratings usually imposed by their company for a history of pulmonary tuberculosis. A few companies were lenient to a degree which was almost alarming after five years apparent cure either with or without operation. Out of 134 replies only four companies were willing to offer more favorable

terms where excision or other fixation operation had been performed.

With such diverse opinion from the best available sources, I am willing to admit most candidly that a moment of discouragement arrived, and that more than once I was on the point of wiring our president and asking him to kindly excuse me from any further effort. But surely when there exists such widely diverse opinion on such a group of cases, it must be because we do not rightly appreciate or estimate the factors affecting insurability; and is it, therefore, not well worth our further careful study? Through the work of the members of this Association, we have reached a certain degree of uniformity in dealing with overweights, albuminurias, pleurisies, heart murmurs, etc., and in a few years much might be accomplished to bringing a certain degree of cosmos out of the chaos at present most evident in dealing with tuberculous affections of bones and joints.

As it appeared to be impossible, or at least impracticable to obtain definite statistics of recent mortality experience in this group, I have been compelled to become somewhat didactic, and to simply review the disease from a clinical point of view, adding only certain results which have been achieved by modern treatment, and which may reasonably be presumed to alter materially our older views concerning the insurability of such risks.

In the case of a bone or joint lesion, the tubercle bacilli reach the site of infection by transmission through the blood stream, or perhaps in very rare instances, through the lymphatics. It is now agreed by most authorities that the involvement in this class

of cases is usually secondary to some pre-existing primary tuberculous focus. In young children, where the most common site of disease is in or near the epiphysis, blood channels other than the nutrient arteries must conduct the organisms. The bacilli gain entrance into the blood stream from the respiratory or alimentary tract, or by direct erosion into an artery or a vein from some other focus which is undergoing degeneration. Having lodged in the tissue and multiplied therein, one of two results must occur.

If the particular variety of organism is of low grade virulence or the individual infected of high grade resistance, the infection may be arrested and overcome, before much, if any, local change occurs; and clinical tuberculosis does not result. But otherwise, the usual too well-known sequence follows, and definite clinical tubercular disease supervenes with the formation of tubercles finally resulting in atrophy, caseation, etc., from which again recovery may occur, or a breaking down process resulting in more or less destruction of the portion of bone or joint involved. The more minute and highly classified pathology does not concern us here, nor is it advisable to delve into the question of human and bovine organisms, but it must be stated that the essential point in tuberculosis of bone or joint is the presence of demonstrable tubercle bacilli. All lesions of bones or joints which give the usual clinical picture of tubercular disease are not necessarily tuberculous.

As early as 1895, Watson Cheyne (whose book entitled, "Tuberculous Disease of Bones and Joints," is to my mind a classic), pointed out some interesting facts concerning this subject. He noted that in the

early stages, the Koch's organism could be found, usually in quite large numbers, in stained sections of the bone or synovial membrane; that later on the number of the organisms diminished very greatly, and that they did not show up by the usual staining methods, although they could be discovered by animal inoculation. This phenomenon was also noted by him in the case of tuberculosis artificially induced by the inoculation of animals with virulent cultures. The bacilli were found in large numbers in sections of infected areas of liver, spleen and various other viscera, while in bone lesions and the synovial membranes of the joints, the organisms were found only in small numbers, and after prolonged search.

After consultation with several modern authorities, who have kindly furnished me with valuable information regarding the usual age of onset of the affection of the various joints, I have been able to find nothing better than the tables given by Cheyne in his valuable book.

Table (1) shows the percentage of proportion of the cases of bone and joint disease commencing in each quinquennial period in males and females respectively:

TABLE 1.

Age	Total	Males	Females
1- 5	23.2	14.3	8.9
6-10	16.	9.5	6.5
11-15	14.6	9.6	5.-
16-20	15.8	9.5	5.8
21-25	8.5	6.5	2.-
26-30	8.8	5.3	3.5
31-35	4._	4._	___
36-40	3._	2.4	.6
41-45	2.-	2.-	---
45-50	2.-	1.8	.2
Over 50	2.-	1.-	1.-

Table 2 shows the percentage proportion of the total cases commencing in each decade affecting the various joints:

TABLE 2.

Decade	I	II	III	IV	V
Hip	30.2	20.3	4.8	---	12.5
Knee	29.5	22.8	18.2	33.6	6.2
Ankle	4.4	5.9	3.6	3.3	12.5
Tarsus	4.6	5.9	8.4	3.3	18.7
Shoulder	----	1.6	4.8	---	18.7
Elbow	6.7	9.2	6.-	13.3	6.2
Wrist	.6	8.4	15.8	13.3	---
Fingers	1.5	4.2	2.4	---	12.5
Ribs	----	----	1.2	10.-	---
Os. Calsis	2.6	2.4	2.4	3.3	---
Odd Bones	6.7	3.2	3.6	---	---
Spine	12.-	15.2	28.-	20.-	12.5

Table 3 shows the percentage relations of male to female with the various joint affections.

TABLE 3.

	Hip	Knee	Ankle	Tarsus	Shoulder	Elbow	Wrist
Males	59.7	57.6	81.9	85.8	50.	74.3	75.9
Females	40.3	42.4	18.1	14.2	50.	25.7	24.1

These figures are practically in accordance with the experience of the Sick Children's Hospital in Toronto, and with the results of Drs. R. A. Hibbs and Herman Von Lackum for the younger ages.

In a series of fifty-one cases of tuberculosis of the knee quoted by Hibbs and Von Lackum in the Journal of the American Medical Association, October, 1925, the age of the patients varied from nine months to fourteen years with an average age at onset of four years. It is generally admitted that the younger aged patients respond to treatment much more slowly than at the older ages, and that recurrences are more frequent. The majority of the children showed marked infeeblement of growth, and could hardly be classed as normal

for their ages. The question of trauma being a factor in the production of bone or joint disease is still undecided, although experimentation with animals seems to prove that it may be one of the determining factors.

The clinical symptoms of tuberculous disease of the various bones and joints cannot be gone into in such a paper as this, but one must add in passing that with the higher standards which are required today before a doctor is qualified to practice his profession, that tuberculosis of bones and joints, like all other forms of the disease, is usually recognized at a much earlier date than was formerly the case. It was a very common occurrence during my house surgeonship some years ago at the Sick Children's Hospital in Toronto, to have cases admitted which had been diagnosed as rheumatism, and treated for months as such, when in reality the condition was tuberculous, and in some cases the disease had progressed to almost complete disintegration of the portions of the bones or joints involved. This condition of faulty diagnosis is now seldom seen—and as early diagnosis is an important factor in prognosis, it has a decided effect on insurability.

Selection

In connection with this aspect of the disease, my remarks will be limited to the group of cases which come under our particular notice. It has been variously estimated that from thirty to thirty-six per cent of the cases suffering from tuberculosis of the bones and joints, die of more or less generalized tuberculosis within a period of eight to ten years. We are naturally only called upon to deal with cases apparently cured

for a period of some years, as it would be more or less suicidal to adopt any other policy. The chief facts, therefore, so far as we are concerned are the severity of the original lesion, the length of time of illness, and the presence or absence of the history of clinical tuberculosis of any other portion of the body. Furthermore, the occupation, environment of the applicant, the type of treatment which had been carried out, operative or non-operative, the question of family history and the applicant's build are all of paramount importance. It is my opinion that treatment received is of very great importance so far as prognosis is concerned.

In Hibbs and Von Lackum's cases of tuberculous knee already quoted, the average time taken to produce clinical cure was six and a half years. Any lowered resistance of the individual tended towards recurrence of the disease. *In sixteen cases where operation was performed to produce bony fusion, no sign of recurrence has occurred.*

I would next like to call your attention to the results achieved by Dr. R. I. Harris of Toronto in connection with the treatment of tuberculous disease of the bones and joints in young adults. This series of cases occurred in men who had enlisted in the Canadian Expeditionary Force from 1914 to 1918.

At the time of enlistment these men were examined and were believed of course to be physically fit. In over 90% of the cases the disease occurred after service in France. It is Dr. Harris' opinion that exposure, fatigue, and the influenza epidemic were determining factors in the production of the disease of bones and joints. In all, 102 cases were under his care. Certain percentages regarding these cases are given below:

DR. R. I. HARRIS' SERIES OF CASES

	Total number of cases	102
	History of tuberculosis in family	10%
*	Previous personal history of tuberculosis	75%
	Tubercle Bacilli found in urine	16%
‡	Multiple foci—definable	35%
	Cases operated upon	61%
	Cured or apparently cured	80%
	Improved, unimproved or died	20%

In 79% of these cases a definite diagnosis of tuberculosis was made by the discovery of the tubercle bacilli. Where animal inoculation was fruitless in the first instance, it was carried out again and again until a definite result of a positive or negative finding was achieved. In some instances where the clinical symptoms appeared to be beyond question, but where guinea pig inoculation with the joint fluid was negative, biopsy was performed, and a portion of the tissues inoculated into animals and the case was definitely labelled "Tuberculous" or "Nontuberculous" on the result.

Dr. Harris was able to determine in the large majority of these cases which of course, occurred in young adolescents, a history more or less definite of some previous tuberculous infection of gland, pleura, or some other site. He carried out in all cases a very complete examination of the other parts of the body, and in many instances was definitely able to prove tuberculous lesions at other sites than the bone or joint. The involve-

* This includes cases with definite history of infected glands, pleurisy, prolonged bronchial or pulmonary conditions, or debility probably tuberculous.

‡ These cases include definite foci in lungs, peritoneum, kidney, testes, or multiple bone or joint lesions.

ment of the genito-urinary tract was most frequently discovered. In one-third of his joint patients, tubercle bacilli were discovered in the urine, and in seventy-five per cent of these no symptoms of involvement of the kidney or bladder were found excepting a few pus cells in the urine. Out of sixty-one per cent of cases operated on, two cases recurred, *but where bony fusion was obtained, there has been no recurrence,* and eighty per cent of them are now back to work of all sorts and descriptions and are entirely self-supporting.

One must, of course, recognize the fact that this series can hardly be taken as a fair average guide; for the reason that they were under ideal conditions for medical and surgical treatment. There was early diagnosis, the men while in hospital were on full pay and allowances, and under free treatment. They remained in hospital under military supervision as long as their Medical Officer required. While not compelled to submit to operation, they were usually willing to do so, when the advantage was pointed out. They remained on full pension for some time after discharge, and were seen by the Pension Board every three months for the first several years, and pensions diminished as the condition improved. Heliotherapy and the greatest care of their general health associated with local treatment of other infected foci was carried out in all cases. Nevertheless, the results of this series are somewhat amazing, and worthy of our careful attention. The results shown by Harris and by Hibbs as well as by practically all modern orthopedic surgeons go far to prove that where true bony fixation is accomplished, the local condition is *cured.* The results of heliotherapy —particularly those given by Rollier at Leysin are little

short of amazing—and the future may hold much in store for combating tuberculous disease along the lines adopted by him and his school.

Conclusions

(1) Tuberculosis of bone or joint is merely a localized evidence of general infection.

(2) While in certain cases the tubercle bacilli may reasonably be presumed to be the cause of the condition under review, a definite and positive diagnosis can only be made after the discovery of the organism.

(3) Unlike pulmonary or even glandular tuberculosis, when a bone or joint is affected, the lesion is usually a "Closed Lesion" and secondary infection with organisms is rare.

(4) Like other tuberculous lesions a certain number of cases follow a progressive downward course until death supervenes. Others an irregular course with periods of quiescence or improvement, but not what can be classed as a definite cure. A third group are definitely cured. It is with this group and this group only that we are concerned as Medical Directors, in the selection of risks.

(5) The cases where bony fusion of a joint is accomplished either by nature or better still, by early operation are decidedly the most favourable, and practically all authorities are agreed that where this result has been successfully attained, recurrence is indeed rare.

(6) It would, therefore, appear probable that where bony fusion has been attained, and the applicant has

had freedom from all symptoms of the original condition, and from the suspicion of any affection of other parts of the body, for a period of five years, that such risks could safely be insured on near standard or standard plans on policies maturing at ages fifty-five to sixty. The early maturity would be safest with our present knowledge, to prevent a possible increased mortality from tuberculosis at the older ages.

(7) It would be interesting, and I am of the opinion decidedly valuable, if for the next ten to fifteen years, the companies represented in this Association would encourage the acceptance of the cases suggested, even if only for small amounts, in order to make a careful investigation and study of the group mortality of such cases under the more modern conditions of early diagnosis and improved treatment.

Dr. Beckett—Dr. Walter C. Bailey of the New England Mutual Life Insurance Company will open the discussion.

Dr. Bailey—I first must extend to Dr. Archibald my compliments for his terse, concise and complete dissertation on this subject, so complete that he has left the discusser of his paper in certain difficulty.

My own company has very scanty experience with this group, but what we have shows the same trend as the general experience. However, superselection out of a generally poor group is a favorite pastime with us and it would seem that we could subscribe to the restrictions enumerated by Dr. Archibald to the end that we could issue policies more freely to the best of them. The requirements for safety mentioned by the speaker; namely, a single focus, five to ten years cured, and on Endowment or other forms with early

termination, have been in vogue with us for 30 years and more.

The way would be made easier for us all if we could hope to assume that, in the general community, the high grade of early diagnosis, care and treatment given the special group quoted by the speaker obtained.

Two statements of the essayist are arresting. First, that thirty to thirty-six per cent of the cases suffering from tuberculosis of the bones and joints die of more or less generalized tuberculosis within a period of eight to ten years.

I assume that this includes the young ages, in which group, as mentioned by Dr. Archibald, great resistance to treatment is shown. In other words, the young tissues have not established a general immunity and the filtering or restraining action of the glandular system has broken down, a point to which I refer later.

Certain it is that if we exclude this group and consider young adults only, the mortality ratio would be much improved.

The second statement that I wish to discuss is incorporated in the report of a remarkable group of cases treated by Dr. Harris of Toronto. I quote: "In one-third of his joint patients, tubercle bacilli were discovered in the urine, and in seventy-five per cent of these no symptoms of involvement of the kidney or bladder were found excepting a few pus cells."

In other words, approximately twenty-five per cent of these cases showed bacilli circulating in the blood stream.

My assumption is that these bacilli were recovered by the ordinary staining methods, but it is not stated

whether they were proved viable and pathogenic by cultural or injection methods.

The fact that they would not decolorize with acid proves retention of the fatty envelope and, therefore, viability and pathogenicity. Furthermore, it takes a high-powered bacillus to penetrate adult normal kidney tissues without restraint and disease formation at point of entry.

The figures quoted are astounding, and I can discover no explanation, for most observers agree that tubercle bacilli are averse to remaining in the blood stream, preferring to settle down in the tissues.

No discussion of any part of the tuberculosis problem is, I believe, complete without some reference, direct or indirect, to the theory of parasitism of the tubercle bacillus first brought out by Theobald Smith* in 1906. Many of you without doubt are conversant with this theory, but I crave your indulgence for a brief recapitulation of a few of the main points.

In the precision of the selective adaptation displayed by the tubercle bacillus as described by Smith, something almost akin to intelligence is ascribed to the bacillus.

The lungs become in this aspect the most favorable seat for a stable parasitic existence as entrance, exit and favorable soil are provided.

In this sense tuberculosis of joints is an aberrant form, as it provides no continuation of life for the bacillus. As a result of this parasitism two related conditions have evoluted: First, a lowered virulence or invasive power of the microbe; and second, the tendency to attack mucous membranes, cutaneous surfaces

*Theobald Smith-Harvey lecture, New York, 1906.

or organs in direct communication with the exterior. The lowered virulence he considers only another expression for localization on the external surfaces, among which he places mucous membranes and respiratory tract.

As a result of this adaptation, tuberculosis has taken largely the form of phthisis. Perhaps the tubercle bacillus keyed to adult life is more invasive in children which accounts for the fact that inspired bacilli penetrate the lung tissue without causing disease and are carried to the mediastinal lymph nodes much as a foreign body would be.

In the lymph node is set up that complicated set of reactions for supremacy on the part of the microbe and the host, the tubercle formation.

"The bacilli are destroyed in part: The rest, through the protecting influence of caseation, provide themselves with the protecting envelope and are ready for further orders."

This latency of tubercle bacilli in lymph nodes has been demonstrated by many observers. The question arises, what terminates the latent period? Here is Smith's theory:

"The tubercle bacilli are unable to multiply in the system when the opsonic power is too low, for the reason that the protecting capsules are not removed. Under such conditions the body is apparently immune, but really is in a state of hyper-susceptibility. When the opsonic power rises, the multiplication begins. This theory would also explain more rationally the greater activity of tuberculosis in certain decades of life."

The idea most generally in vogue is that in childhood there is excessive activity of the glandular sys-

tem. After puberty, this activity is in abeyance and thus there occurs the high incidence of tuberculosis in young adults.

There is much more of valuable knowledge brought out by Smith in discussing his theory of parasitism which may not be noted here on account of lack of time, but I think that enough has been mentioned to warrant my assertion that in studying tuberculosis of joints or any other phase of the question that an appreciation of Smith's theory is necessary for complete understanding.

Dr. Archibald—Dr. Harris was able to demonstrate tubercle bacilli in the urine in 16% of the 102 cases which are mentioned. One must remember that in many of these cases the lesions were multiple, and not confined to bone or joint alone. Harris' attention to the urine is due to the fact that several of his cases showed definite evidence of renal tuberculosis. He then carried out as routine practice, careful bacteriological examination of the urine. He tells me that he never in practice sees a case of tuberculosis of bone or joint without having the urine bacteriologically examined, that is to say, both microscopical and guinea pig inoculation of the urine. If the original result is negative, but should any pus cells be found on subsequent examination, further bacteriological investigation is made.

In quite a number of cases of tuberculosis of the bone, he found tuberculosis of the testes and vas as secondary lesions, so that it also became part of his routine to make a careful examination of testes and vas in his bone cases.

Regarding Dr. Bailey's remarks as to the theory of

Theobold Smith, I feel that I can make no further comment.

May I say in closing that I am pleased to bring this subject before the meeting, because it appears to me to have a very practical bearing on a certain group of insurance risks.

Dr. Beckett—I want to thank you for your splendid attendance and to say that we have, I think, a very interesting program for tomorrow and I hope we will see you all back in your places tomorrow. The meeting is adjourned until tomorrow morning.

SECOND DAY

President Beckett in the chair.

The Secretary announced that he had cast a ballot as instructed for the election of the officers and members of the Executive Council placed in nomination on the preceding day, as follows:

President,	Dr. Robert M. Daley
1st Vice President,	Dr. J. Allen Patton
2nd Vice President,	Dr. William Muhlberg
Secretary,	Dr. Chester T. Brown
Treasurer,	Dr. Charles L. Christiernin
Editor of the Proceedings,	Dr. Eugene F. Russell

Members of the Executive Council:

Dr. George A. Van Wagenen
Dr. Edwin W. Dwight
Dr. Morton Snow
Dr. Robert L. Rowley
Dr. Ross Huston.

These officers and members of the Executive Council were declared duly elected.

Dr. Beckett—We are very fortunate this morning in having with us Dr. Chadwick, who will read his paper on "The Diagnosis and Prognosis of Tuberculosis in Children." Dr. Chadwick has charge of the Tuberculosis Hospital for Children at Westfield, Mass., and I know of no one who can speak more authoritatively regarding this very important branch of medicine than Dr. Chadwick. I take pleasure in introducing him to you this morning. Dr. Chadwick.

THE DIAGNOSIS AND PROGNOSIS OF JUVENILE TUBERCULOSIS

by Henry D. Chadwick, M. D.
Acting Director, Division of Tuberculosis, Westfield, Mass.

This paper is based upon the examination of 50,000 school children between the ages of five and fifteen carried on for the last three years by the Massachusetts Department of Public Health as a part of the Ten-Year Program for the prevention of Tuberculosis; also on my experience as Superintendent of the Westfield State Sanatorium, which is an institution having three hundred beds devoted to the care of tuberculosis children.

Hilum Tuberculosis: This term is used to designate the juvenile type of tuberculosis. It is essentially a disease of the lymph glands. Following a first infection, a primary nodule develops in some part of the lung parenchyma, and the tracheo-bronchial lymph nodes draining that area become infected and diseased. This is the primary complex first described by Ranke. It is the usual form of tuberculosis found in children and but rarely in adults.

Diagnosis is made by considering the following factors:

History: Evidence of contact with an open case of pulmonary tuberculosis is very important, as we have found four times as many cases of hilum tuberculosis and twice as many cases of pulmonary tuberculosis among the contact children as were found among the children with no history of exposure.

Symptoms: Undue fatigue, lassitude, anorexia and nervous irritability are the most common symptoms. Cough and fever, so often present in pulmonary tuberculosis, are rarely found in the juvenile type.

Tuberculin Test: A positive Von Pirquet or intracutaneous tuberculin test is essential to make certain of infection. In children from five to fifteen years old, a positive reaction may not indicate active disease, but it probably does mean that the child is harboring living tubercle bacilli. The question of activity must be determined by symptoms and the general physical condition. The percentage of reactors gradually increases from 20% at age five to 35% at age fifteen. The intracutaneous test is a little more accurate, but is not practical to use in school clinics.

The X-Ray: A Roentgenogram is the most valuable aid in the study of these children. Without it, no absolute diagnosis of hilum tuberculosis can be made. Neither is a physician justified in eliminating tuberculosis as a possible cause of ill health in a child, unless the X-ray film is found to be negative.

The work of Doctors Opie and McPhedran, of the Phipps Institute, in their studies of the lungs of children who had died of other diseases than tuberculosis, have given us a sounder basis for the interpretation of X-ray shadows found in the lungs. They have demonstrated that enlarged tracheobronchial glands only appear as opaque shadows in a Roentgenogram when they contain a deposit of calcium. Also that calcium is deposited in glands or nodules only when they are tuberculous.

Slight changes in area or of density of the hilum shadows are of no significance. If, however, there

appear areas of increased density at the root of the lung in the region of the normal hilum shadows or along the trachea, that have the form of glands or gland masses, then we are justified in assuming such shadows to be due to calcified, tuberculous glands. Frequently when such glands are found, there is one or more calcified nodules in the parenchyma of the lung. Rarely one finds a large area of homogeneous shadow extending from the hilum or well out towards the periphery, due to an exudate resulting from the inflammatory reaction set up by a recent first infection with tubercle bacilli.

If such a case is followed by serial films taken at several months intervals over a period of one to three years, one finds that absorption of the exudate gradually takes place and eventually only a small, calcified nodule remains at the site of the infiltrated area.

Of the five factors that one should consider in making a diagnosis of hilum tuberculosis, the most important ones are a history of exposure to pulmonary tuberculosis, a positive tuberculin test and X-ray evidence of calcified nodules in the lung or tracheobronchial glands. If the symptoms enumerated above are present, they indicate an active process; that is, the balance between the focus of disease and the child's resistance is not being maintained.

Latent Hilum Tuberculosis is a term used to describe the cases of juvenile tuberculosis quite often met with in children in which there are no physical signs or symptoms of disease. The Roentgenogram, however, may show calcified masses at the hilum or one or more nodules in the lung. The tuberculin test

is positive, which means living tubercle bacilli are present. In such cases, an unstable immunity exists. A lowered resistance, due to an intercurrent disease, a reinfection from the child's own focus or from outside sources, may quickly convert a latent case into an active one.

Incidence of Infection: Our State Clinic statistics show that 29.6% of nearly 25,000 children between the ages of five and fifteen reacted to the Von Pirquet tuberculin test. As this group was made up of 16% contacts and many underweight children, this percentage is considerably higher than the average would be if all the children were given the test with no attempt at selection. The percentage of reactors among the contact children was nearly twice as high as among the noncontact group. One community that had been colonized extensively by tuberculous families had a very high percentage of reactors.

The children who were underweight had a little higher percentage of reactors than those who were average weight. The rural group showed 27.5% reactors as compared with 29.9% for the urban children. All the school children in three small towns were given the tuberculin test and the reactors averaged 16%.

The percentage of infected children appears to be much less than has been found in previous surveys. As evidence of this reduction, it is interesting to compare the results obtained by the State Clinic examiners in 1926 in Framingham with those found by Dr. P. C. Bartlett in the work he did for the Framingham Demonstration in 1917. Dr. Bartlett gave the tuberculin test to 460 children from one to seven years of age and found 33% of them infected.

The State Clinic examined 520 children from three to fifteen years of age and 25.5% reacted to the tuberculin test. When we divided these children into age groups, we found that the Demonstration group, age five to seven years, showed 52% reactors and the State Clinic group of corresponding age, only 14.2% —a decrease of 38%.

The Incidence of Tuberculous Disease: It must be kept in mind that the figures that I present report the findings in a selected group of school children. In this group, there were 16% contacts and 37% of the whole number were 10% or more underweight. Therefore, only a little less than half were average weight children.

A diagnosis of hilum tuberculosis was made in 3.7% of those examined. 10.4% more were classified as suspects. These suspects were reactors who did not show definite X-ray evidence of a tuberculous lesion, but who were malnourished and in poor physical condition. A child may have tuberculous tracheo-bronchial glands that are much enlarged and undergoing softening and caseation, but if there is no deposit of calcium in them, they will not cast a shadow that can be distinguished in the Roentgenogram. Therefore, a poorly-nourished child known to be infected with tubercle bacilli, as shown by the tuberculin test, should be given careful supervision, even if the Roentgenologist reports a negative film.

Instead of taking our selected group of children as a basis, we can arrive at a more accurate estimate of the number of tuberculous children of school age by obtaining our figure from the number of reactors where all the children of a community are given

the tuberculin test. The three rural towns where we gave the test to all the children had 16% reactors. As the small towns throughout the state averaged 2.4% less reactors than the urban communities, it would seem equitable to add this difference to the rate found in the towns and consider 18 to 20% as the state-wide average.

We found in our clinics that 12.5% of the reactors were diagnosed as having hilum tuberculosis and 35% more of them were classified as suspects. 47.5% of the reactors, therefore, appeared to be in need of special care or treatment. This would be equivalent to between 9% and 10% of the whole school population below the high school grade. This estimate does not seem to be excessive when we study the death rate from tuberculosis.

Last year 6.5% of all deaths in Massachusetts were from some form of tuberculosis. 18% of these were in persons under twenty years of age. We found but fifty school children, out of 25,000, that could be classified as having the adult type of pulmonary tuberculosis. Some of these seemed to have the secondary or adult type superimposed on extensive primary or juvenile type. Such cases may be due to long-continued association with a person having an open case of pulmonary tuberculosis or to reinfection from their own foci of disease. This latter may take place from direct extension from a primary nodule or more often through the rupture of a caseous gland directly into a bronchus or blood vessel.

Prognosis: We find from our experience that the children with hilum tuberculosis, who have sanatorium treatment long enough to reach average

weight, develop good musculature and live the normal child's daily life without undue fatigue, that they remain well after discharge, provided their home conditions are reasonably good.

Roentgenograms taken at intervals will show a gradually increasing density of the nodules and tuberculous glands as the deposit of calcium takes place and the absorption of any exudate there may be about them. Occasionally, nodules or glands that appear to be calcified will undergo absorption. The fact that calcified areas are seen, however, does not assure us that the whole diseased focus has become healed. Furthermore, there may be other caseous glands in which healing has not reached the point where sufficient calcium has been deposited to produce a shadow that can be seen in the film.

It is Dr. Opie's opinion that living bacilli may persist in or about apparently well-calcified foci, at least through the period of adolescence. He also states that after twenty, probably the calcified foci do not contain viable bacilli.

We are now endeavoring to trace the children who have been discharged from the Westfield State Sanatorium to determine how many have subsequently developed the adult pulmonary tuberculosis. I know that such a sequence but rarely occurs.

Corroborative evidence that many school children have hilum tuberculosis is obtained by the examination of older students. We have taken Roentgenograms of 3,800 college, normal school and high school students. Only 900 of this group were in the high schools. We found six students with the pulmonary type of tuberculosis, and two hundred and thirty-one

had the latent hilum type of disease. This is 6% of the whole number. Their lesions had been in existence some years, as they had well-calcified pulmonary nodules or tracheo-bronchial glands. We know that frequently tuberculous nodules and glands entirely disappear through absorption; therefore, our estimate of 9% to 10% of the whole number of school children having this glandular type of disease is not excessive.

Summary and Conclusions: From 18% to 20% of the school children in Massachusetts are infected with tubercle bacilli, as shown by the Von Pirquet tuberculin test. Approximately one-half of these have signs or symptoms or X-ray evidence of the juvenile type of tuberculosis. The prognosis in those children, if they are discovered before the secondary or adult type develops, is excellent, provided they receive good home supervision or care, or when they have preventorium or sanatorium treatment.

It is probable that many of the deaths from tuberculosis that occur in adolescence and early adult life are the result of massive infection in childhood that was unrecognized and untreated. We also find that the early pulmonary case in children, if found and treated before tubercle bacilli are present in the sputum, the prognosis is good. If, however, these secondary lesions go on to the ulcerative stage and bacilli are set free, then the child, if under sixteen years of age, will almost invariably die of pulmonary tuberculosis, regardless of what treatment is given.

Dr. Beckett—We are surely indebted to Dr. Chadwick for this splendid paper and the splendid demonstration of this condition in children.

We expected to have Dr. Bigelow, the Commissioner of Public Health of Boston, Mass., here this morning, to open the discussion on this paper, but I received a letter from him stating it was quite impossible for him to be here.

I will ask Dr. Knight to continue the discussion of Dr. Chadwick's paper.

Dr. Knight—This excellent paper presents an impressive example of one of the outstanding present day methods of studying and of attacking tuberculosis. Here these specialists like Dr. Chadwick have learned that juvenile tuberculosis or tuberculosis of the tracheobronchial lymph glands is quite a different affair with quite different characteristics and manifestations from pulmonary tuberculosis, that generally attacks at older ages, and they have learned and are demonstrating that by the detection of these cases through tuberculin tests and through X-ray examinations at the earliest possible stages; and by giving the afflicted ones good sanatorium treatments long enough to build up an average nutrition and good strength they may then remain remarkably well after discharge "provided their home conditions are reasonably good."

Dr. Chadwick has stated that this report of his is based principally upon the examinations of 50,000 school children and upon the treatments and after-care of those who were found to be infected. That same sort of good work is being done by others and it is bound to extend rapidly throughout the country as other good men are and will be taking it up.

It is no wonder that Doctor Chadwick has asked whether we, as medical representatives of the life insurance companies, can recommend these successfully treated cases of juvenile tuberculosis for

standard insurance. They think of them as very good risks and they say, without hesitation, that, if these people are to be declined for insurance, just as soon as they acknowledge that they have had and have been treated for juvenile tuberculosis, then that fact will, to a serious degree, injure the carrying on of their present program, the parents will hesitate to accept either the examinations, the sanatorium residence or the home treatments, and thus the curative services in this promising field will be seriously curtailed. We, of all physicians ought to try to avoid that danger. We ought to help in every way that we can, and I am sure that we shall be glad to do so. The question is put squarely before us though whether we as Medical Directors, can determine that these arrested cases are eligible for insurance and at standard rates. These best specialists report that they are staying remarkably well and that as they grow up they rarely develop pulmonary tuberculosis. They have already watched it for a number of years. Shall we find that this is so as we follow these groups through the ten, twenty, and longer periods of adolescence and of adult life as will be necessary to prove the actual mortality experiences? It may look at the moment as if this set-up is of interest to only the Industrial companies, but these individuals are soon at the adolescent and adult ages wherein you are all concerned.

We all know the extents to which family histories and personal histories of pulmonary tuberculosis modify the life insurance risks. We all agree that contact and especially prolonged contact with tuberculosis either in infancy, childhood, adolescence, or adult life, is a very important factor. And I am deeply impressed by Dr. Chadwick's report that he found

four times as many cases of this infantile tuberculosis and twice as many cases of pulmonary tuberculosis among the cases of contact children as he did among the cases with no history of such exposure. Thus it seems to me that these same children who are growing up after their discharges from the sanatoria and from successful treatments will have the same family histories and doubtless certain amounts of the same contacts with tuberculosis, and I cannot help wondering if they will not themselves be further afflicted with tuberculosis to greater extents than will leave their morbidity and mortality rates within our normal tables. I am awfully anxious not to be wrong about it, but my feeling is that we must first ask and get satisfactory answer to the question whether sufficiently large groups have yet been followed for a sufficient number of years to prove that those children who have been infected with the infantile type of tuberculosis have thereby acquired such a power of resistance that they will only rarely develop adult tuberculosis. And, meanwhile, we must also remember that the length of time that has elapsed since the infection was arrested is still an important factor. I should think that like the pulmonary cases these of the juvenile type of tuberculosis would have to be considered as rather poor risks for at least five years after the disease had become quiescent, and perhaps only fair risks during the next five years. I firmly believe, though, that this juvenile type sets up a decided degree of immunity so that those children are less likely to develop the pulmonary type of tuberculosis later on.

Dr. Beckett—Is there any further discussion? Dr. Bailey.

Dr. Bailey—This paper of Dr. Chadwick's is just

as sound as his work has been. I defy anyone to pick a hole in it. Some years ago, as the Chairman of the Board of Trustees of Massachusetts State Hospitals for Tuberculosis, I had the honor of being associated with Dr. Chadwick, saw a great deal of his work at the Westfield Sanatorium, and have followed it with great interest ever since.

Fully twenty years ago, I became convinced that the great reservoir of adult tuberculosis consisted in childhood infection, and, at that time, saw a great many children at the Dispensary of the Boston Tuberculosis Hospital. We got very little help from the X-ray at this period, but a careful study of the cases showed a definite symptomatology. I began to make diagnoses of tuberculosis in these children, and very soon ran against the authorities, who said: "There is a certain difficulty in making the diagnosis of tuberculosis in these children because they are immediately shut out from school." I replied that the sooner we had a group of fathers and mothers coming to the clinic, and objecting to having the children taken out of school because of this diagnosis, the sooner we would have special schools for this group. The work went on, and Dr. Chadwick and others have proved the contention without any question, that childhood infection is the most important point of attack.

I must speak of Dr. Chadwick's point of view. He is, as you can see, not a militant, self-seeking person. He has not spouted and fumed; he has simply gone on quietly with his work, giving the facts, and he has always been ready to help seekers after the truth in this important subject. We wish there were more Dr. Chadwicks in all branches of medicine.

The question of refined diagnosis—and it is a refined diagnosis—is unquestionably difficult for the ordinary examiner for life insurance. Even among the children specialists, the importance of the symptoms and signs enumerated by Dr. Chadwick are not appreciated by any means. It is a highly specialized department of medicine. We, as insurance Medical Directors, are, and rightly should be, extremely interested in this group, and should keep in mind the splendid work of the Metropolitan in making the demonstration concerning tuberculosis at Framingham, Massachusetts, which I am inclined to believe is not widely enough known and valued.

In regard to the insuring of these children in later life who have had this record of hilum tuberculosis, I confess to a certain amount of confusion. I think if the economic conditions of this country continue at the present peak, the figures presented by Dr. Chadwick will continue to be good. As you know, we have had a tremendous increase in high school population in the last ten years, which denotes prosperity. Business activity and good wages mean that the children, instead of going to work in factories, go to high school, and have another three or four years of good care, out-of-door life, and freedom from strain which working life brings. If we have an economic crisis, the high school population is going to decrease, and Dr. Chadwick's curves are not going to look as well as they do now, in my opinion.

Referring again to the question of insurance for these children in later life who have been definitely diagnosed as having hilum tuberculosis, I may be erring on the safe side, but I do not consider that they are safely insurable until after they have reached the age

of twenty-five years, and then only with a very careful examination.

Dr. Beckett—Dr. Gordon Wilson of the Maryland Life.

Dr. Wilson—Having had a hemorrhage some twenty years ago myself, I have been more or less interested in tuberculosis during the past twenty years. I have been especially interested in the question of hilus tuberculosis in children, which, as Dr. Chadwick said, is well known. He said that there is almost an absence of X-ray signs in early hilus tuberculosis of children. I don't say tuberculosis of the lungs on purpose because I think we, as Medical Directors, have to get the right point of view in regard to this disease in children in assessing a value on such a history. We recognize today that fistula is tuberculosis in 80 per cent of all cases, but we don't give the same rating to a man who had fistula ten years ago and is overweight today, as to a man who had pulmonary overweight ten years ago and is well today, and I think we are going to do justice to ourselves and justice to these children when as adults they apply to us for insurance, if we look on the disease not as pulmonary tuberculosis, but as gland tuberculosis. It does not have the clinical features of pulmonary tuberculosis, it has a low mortality, and it has something which pulmonary tuberculosis has not, a degree of immunity and a persistence of immunity which is entirely different from pulmonary tuberculosis, so that the important thing for us to bear in mind in assessing a value on this impairment is to always bear in mind that it is not pulmonary tuberculosis but hilus tuberculosis.

Dr. Beckett—Is there anyone else that would care

to discuss this subject? I will ask Dr. Chadwick to close the discussion.

Dr. Chadwick—I think that the point made by Dr. Wilson is very important, and that is for you to realize the very marked difference between the juvenile type of tuberculosis, which is a disease of the glands, and pulmonary tuberculosis, which is a disease of the lungs. In one, the gland type of the disease, you have a very low mortality, while in the pulmonary disease, you have a high mortality, and the better care these children with this juvenile type of the disease receive, the fewer cases of pulmonary tuberculosis there will be in early adult life. I would feel myself that when five years had elapsed after the diagnosis of the juvenile type of tuberculosis had been made, and the child continued to keep well after treatment, that there was very little likelihood of developing either the glandular or the pulmonary type later on in life. I should feel that they were good risks and that they shouldn't be penalized by a higher rating or refused insurance.

I think too, that the financial side of the insurance business will be benefited by all these child-welfare activities. They are all anti-tuberculosis work, as anything that improves the general welfare of the child will lessen the mortality from tuberculosis. The decline in the death rate will continue and you know that it has declined very fast in the last two decades. So it seems to me that you could well afford to be liberal and continue to insure these children as you have done in the past by disregarding hilum tuberculosis and be on a sounder basis than you have been in the past.

Dr. Bailey—From a practical point of view, suppose,

Dr. Chadwick, you were a Medical Director and there came before you a case of a young adult, good weight, etc., good general appearance, no history of any trouble and pronounced cured of hilum tuberculosis perhaps five years previous. Now, if you could find nothing in that examination, other than a marked D'Espine sign, a sign described by D'Espine of increased bronchophony over the upper vertebra and extending down into the costal region, would you consider that man a good subject, a safe risk for insurance?

Dr. Chadwick—Yes; I would say that that man was a good risk. I should prefer in such cases to have an X-ray examination, rather than a physical examination, and if the roentgenogram showed definite, hard calcified nodules in the lung, I think from the pathological studies that have been made that we can feel quite sure that in such a case there are no living bacilli at age 21.

In our college examinations, we have found that some of the best athletes show similar conditions. One excellent football player was a big fellow, 18 years of age, with no history of contact with tuberculosis, but he had very large, densely-calcified bronchial glands, but showed no physical signs of disease.

Dr. Wilson—A case showing physical signs is sufficient evidence that you are dealing with more than simply a healed but rather an arrested case in an adult of 21 years of age?

Dr. Chadwick—Yes; and one of the adult pulmonary type.

Dr. Beckett—We will now take up the paper by Dr. F. R. Brown of the New England Mutual Life Insurance Company, entitled "A Study of our Urinary Analyses During the Past Twenty-three Years, with Some Suggestions for the Future."

A STUDY OF URINARY ANALYSES

MADE BY THE CHEMISTS OF THE NEW ENGLAND MUTUAL LIFE INSURANCE COMPANY DURING THE YEARS 1903-1921, INCLUSIVE, WITH SOME SUGGESTIONS FOR THE FUTURE

by FREDERICK R. BROWN, M. D.

Acting Chemist and Home Office Examiner.

This investigation is made by policies rather than amounts, and is based upon the American Experience Table, at Attained Ages and by Ages at Entrance.

The group investigated consists of 10,480 cases, issued and paid for during the years 1903-1921, inclusive, and carried down to 1927, in which an examination of the urine was made by our chemists. It is made up of risks which were accepted for insurance on standard forms as a result of these examinations. It should be appreciated that this group consists almost exclusively of cases which, without special investigation, would be considered as impaired, the impairments varying over wide limits, but are practically those in which an excess death rate from Circulatory Disease might be expected. Large cases, without other impairments, are included but, as we know, the general experience with large policies is in excess of the normal.

The whole group may be considered as one which, while impaired in its individual membership, has been examined more carefully and by better men than any other group to which we have issued policies.

The average mortality for our total business during the years 1903-1921, inclusive, was 55.00%. The mortality of the group under investigation was 60.93%.

This investigation has consisted of a general inquiry into the effects upon mortality of specific gravity, urea percentage, sulphates, earthy phosphates, alkaline phosphates, chlorides, albumin, casts and sugar, and upon hematuria and pyuria with varying combinations of two or more of these factors.

The criticism may arise that by dividing our policies into so many groups we delevop erratic and unreliable data. This might be true if we were to consider each chart at its face value and as being absolutely accurate. However, each chart is studied in its relation to other groups of a similar nature, and in this way deductions may safely be drawn. The general trend of all these groupings is unmistakable and will be referred to later. For a complete discussion of the value of small classes, I would refer you to Dr. Dwight's article, "The Value of Small Classes" (1).

It has been clearly demonstrated by methods of superselection that we have been able to control the general mortality of a group without influencing the specific mortality for the determinate factor of the group.

This may be illustrated by consideration of cases with a personal history of sugar in which the general mortality was far and away below our company average mortality, although deaths from diabetes were many times greater than the company average of deaths from this cause.

When this group was subdivided into groups with personal history of sugar, with and without other impairments, those without other impairments showed a mortality 9% lower than did those who showed sugar and other impairments. However, when we examined the group with a personal history of sugar with circulatory impairments, the mortality jumped some 16%

above the general group of those with a personal history of sugar only, and in this group (personal history of sugar with circulatory impairments) it is worthy of note that there are no deaths from diabetes and that deaths from heart disease and diseases of the circulatory system in general are away above the average.

We expect to show that while our urinalyses have improved our general mortality, and have practically eliminated nephritis as a cause of death, they have not controlled our mortality from heart and circulatory disease. They have improved the mortality among heavyweights.

We expect to show clearly the beneficial effects upon mortality of a urea percentage above 1.75% and a specific gravity about 1.020.

Our mortality where there was a personal history of albumin was satisfactory, as was our mortality where there was a personal history of casts. When, however, to this personal history of albumin or of casts was added a personal history of circulatory impairments, there is a great increase in mortality. We believe our present methods of dealing with circulatory impairments will adequately control the mortality from these conditions.

Regarding the decrease in the percentage of deaths from nephritis, it might be argued that this diminution is due to the tendency towards ascribing deaths, where renal disturbances are present, to heart and circulatory disease. However, if you will consult Table No. 2 in Dr. Dwight's article (2), "The Next Job in Preventive Medicine," you will see by the census reports that deaths from Bright's Disease per 100,000 were greater in 1922 than in 1905.

Since these census reports and our reports as to causes of death are, by and large, from the same physicians all over the country, it is reasonable to assume that the diminution which we found in nephritis is real as well as apparent.

It might we well to consider some of the views regarding the urinary solids.

The specific gravity of the urine depends almost entirely upon its content of urea and sodium chloride. These two constituents make up forty-five out of sixty grams of the total solids of an average twenty-four hour urine. Furthermore, it is these two constituents which vary to any extent (3).

Now the specific gravity of the urine or of any solution containing more than one solute is the summation of the several specific gravities which would result, if each solid were dissolved singly, to the same volume of solution. In other words, each individual solid contributes an increment which varies with the concentration of the substance (4). Burton-Opitz and Robert Dinegar, studying viscosity and specific gravity of urine, consider the former the more certain means of determining the character of the urine (5). It is possible that changes in viscosity may account for the occasional urines we get with a normal or high specific gravity, but with a low urea and low chlorides.

It has long been known that a persistently low specific gravity is a danger signal, indicating in most instances a marked degree of renal insufficiency. Hedinger and Schlayer (6) were the first to develop a method by which one could measure the concentrating ability of the kidneys. They were soon followed by Mosenthal (7), who simplified the procedure, and who

again in 1918 (8) made the test possible for the ambulant case. At that time, Lyle and Sharlit studied the test meal with special reference to extra renal factors (9). It had been concluded in 1916 (10) that the test meal with its specific gravity determinations gives the earliest indication of diminished renal function. Christian (11) feels the same way, but places the stress on the specific gravity and volume rarely determining the chlorides and nitrogen.

In 1920, Mosenthal (12) reports the results on ambulant cases. To summarize, if the ability of the kidney to concentrate the urine is as high or higher than the normal standard (1.020), renal excretion is satisfactory *provided the amount of urine is adequate.* This may be so considered even on an unknown diet. Addis and Foster (13), after studying the specific gravity of the urine of normal persons under varying conditions designed to place a strain on the concentrating activity of the kidney, found that not even an approximate idea of the work of the kidney in the excretion of solids could be obtained, due primarily to the fact that each dissolved substance has its own specific effect on the specific gravity of a solution, and the relative concentrations are unknown. However, their conclusions are refuted by Sharlit and Lyle (14). Fishberg (15), however, feels that specific gravity of the urine serves as a measure of the molecular concentration sufficiently accurate for clinical purposes, and concludes that the specific gravity test is the most useful variety of the concentration tests.

Regarding albumin and casts, the conclusions of Dr. Dwight (16) are as follows:

First: That albumin in minute traces is not only

frequently found in normal urine, but is a normal constituent of the urine.

Second: That after severe exercise, mental strain, and under certain other conditions it is constantly found in detectable traces in individuals who give every other positive evidence of being in good health.

Third: That in the majority of normal individuals a much less degree of exercise or mental strain will be associated with the presence of albumin in detectable traces.

Fourth: That the amount of albumin has no bearing upon the prognosis, and that in normal individuals severe exercise will cause a large amount, even up to or beyond 1/4%.

Fifth: That hyaline and granular casts do not of themselves demonstrate the presence of organic disease of the kidney. They may be found in the urine due to the same causes which are responsible for albuminuria. These conclusions are as valid now as when they were drawn, and I can add nothing of value unless it be to cite a few recent investigations.

Roger I. Lee (17) found that 5% of the freshman class at Harvard University presented definite albuminuria in a single specimen of urine passed at the time of examination. Re-examination of 100 unselected students showed that 5% had albuminuria. However, it was not the same 5% which had albuminuria at the first examination. It occurs so frequently in otherwise healthy boys of average physique that it should be discounted as an evidence of disease in the absence of renal damage.

MacLean (18) found the same percentage of albuminuria in 50,000 soldiers under military training, and following these soldiers into active war service found that of 132 developing nephritis, only 17% had shown albuminuria in the earlier examinations when there was no evidence of an actual nephritis.

Capitan (19), studying French and British soldiers, found albumin considerably more frequent among the latter than among the former, and draws attention to the much greater protein intake of the British. However, he concludes, as have his predecessors, that transient albuminuria is universally frequent.

Frothingham (20), writing in Nelson's Loose Leaf Medicine, states that the presence of albumin may be of no significance as far as kidney disease is concerned.

Christian (21), writing in Oxford Medicine, states that individuals found to have albumin and casts in one or several examinations do not necessarily have nephritis, or any greater probability of developing a subsequent nephritis than individuals never known to have shown these urinary changes. Quoting Cushny (22), he goes on to say that casts originate from material excreted through the glomerulus, which in the tubule shortly coagulates as a hyaline matrix. In this matrix are caught cells, and cell remains, or granules which are coarse or fine. If the casts are hyaline, this points to a slight glomerular leakage with no evidence of degeneration of the epithelium lining the tubules. If this epithelium is degenerating, it will be represented by entire cells or by fragments of cells and granules according to the degree of activity of the kidney lesion. The significance of casts is comparable to the significance of albumin.

Having these remarks in mind, we investigated our

policies from the point of view of varying specific gravities. We divided them into groups with a specific gravity below 1.018, with a specific gravity 1.018-1.021; 1.021-1.025, and with a specific gravity over 1.025. The general mortality in each group was satisfactory. However, with a low gravity, there was an early life mortality which did not obtain with the higher gravities. Nephritis is well below average in all groups.

Heart disease as a cause of death is high in each group where the specific gravity is above 1.018, but lower where the gravity rises over 1.025.

When we examined the policies according to the gravity, where there was a personal history of albumin, we found there was a definite drop in the mortality percentage as the specific gravity rose. With low gravity there is a high mortality both at attained ages and by ages at entrance which does not appear definitely as the gravity rises above 1.021. *Heart disease* and *nephritis drop as causes of death as the gravity rises.* On comparing groups with a personal history of no albumin under similar divisions according to gravity, we find that *a personal history of the absence or presence of albumin has no apparent influence on mortality when the specific gravity is above 1.021.* Where there is no history of albumin, heart disease is high as a cause of death, and the effect of gravity on this cause is not evident.

Examining groups where there is a personal history of albumin with other impairments, we find a satisfactory mortality except where the gravity is below 1.021. Heart disease is high but decreases as a cause of death as the gravity rises. Nephritis is well below normal in each group, although it is highest where the gravity is under 1.021.

Considering the cases where there was a personal history of albumin without other impairments, we find a satisfactory mortality which, however, is higher where the gravity is below 1.021. Circulatory disease is high as a cause of death in each group. Nephritis drops rapidly as the gravity increases and is above average only where the gravity is less than 1.021.

Taking the groups with personal history of albumin and casts, the general mortality is entirely satisfactory, except where the gravity is below 1.021, in which case the mortality is almost twice as high as in those cases where the gravity is above 1.021. Deaths from circulatory disease are very high in each group, decreasing slightly as the gravity rises. Heart disease is high as a cause of death, but is less where the gravity is above 1.025 than where it is below 1.021. Nephritis is considerably above average with a gravity below 1.021, and well below average in the other two groups.

Examining those cases with a personal history of albumin without casts, we find a satisfactory mortality throughout. Circulatory disease is slightly above average in all three groups and heart disease is high but increases as the gravity rises. Nephritis, also, is well below average in each group, decreasing as the gravity rises.

When we considered the group with a personal history of albumin and casts with other impairments, we find a satisfactory mortality where the gravity is above 1.021, and an excessive mortality where it is below 1.021, averaging some 50% higher. Nephritis is well below average in each group as a cause of death.

We have investigated the mortality with a personal history of casts, hyaline casts, granular casts, and other casts. The mortality is the same in each group

and is comparatively satisfactory. Circulatory deaths are high in each group. Nephritis is well below average in each group, except that with a personal history of granular casts where it is slightly above the average.

When we consider the cases where there is a personal history of hyaline, granular, or other casts with and without other impairments, we again find an essentially satisfactory mortality, 65.55%. The only feature of note is that where there is a personal history of granular casts with other impairments there is a marked increase in nephritis. When we come to examine the cases with a personal history of casts according to the specific gravity, we find an excessive mortality where the gravity is below 1.021, and the lowest mortality where the gravity is above 1.025. Nephritis is at the average where the gravity is below 1.021, well below normal where the gravity is above 1.021, and lowest where the gravity is above 1.025.

Pyuria. We investigated cases with a personal history of pyuria and found that the mortality was at the upper limits of what we consider satisfactory for the general group of so-called impaired risks, being 71.23%, whether there were other impairments besides pyuria or not. Where there is a history of pyuria and circulatory impairments, the mortality is much higher. Heart and circulatory deaths are high and nephritis is well below the average.

Hematuria. Investigating the cases with a personal history of hematuria, we find a satisfactory mortality, 66.39%, except where this personal history of hematuria was complicated by circulatory impairments in which case the mortality is double that found where

there was no history of circulatory impairments. It is interesting to note that pulmonary tuberculosis is negligible as a cause of death except where hematuria is complicated by the presence of circulatory impairments. Nephritis is above the average as a cause of death, in the general group with a history of hematuria. Although there are no deaths from this cause where hematuria is complicated by circulatory impairments, it is considerably above the average where hematuria was associated with still other impairments.

Sulphates. We have also investigated the effects of varying amounts of sulphates in the urine. Before considering these, it might be well to present a few general remarks on the presence of sulphur in the urine.

In going over the current literature regarding sulphur metabolism. Dr. H. B. Lewis presents a very excellent resume with a splendid bibliography, in the Journal of Physiological Review for 1924.

Sulphur is found in the urine in three fractions: Inorganic sulphate sulphur, ethereal or conjugated sulphate sulphur and unoxidized or the so-called neutral sulphur. Of these three fractions the inorganic sulphate sulphur forms by far the greatest part.

Of the various forms of sulphur which are concerned in metabolism, the greater part enters the body in organic combination and chiefly as protein sulphur (23). While the ratio between nitrogen and sulphur in protein is approximately 16 to 1, there are many notable exceptions. In general, maximal elimination of sulphur after the ingestion of proteins, precedes or coincides with the maximal nitrogen elimination.

It is generally accepted that any factor which influences protein metabolism and the elimination of

urinary urea, will also affect the excretion of inorganic sulphates since both of these constituents have a common origin in the protein molecule; the one from the nitrogen, the other from the sulphur.

Folin, in a series of analyses of urine from normal individuals on high protein diet, recorded the average figures for the distribution of sulphur in percentages of total sulphur: Inorganic sulphate sulphur 87.8%; ethereal sulphate sulphur, 6.8%; neutral sulphur 5.1% (24). Of these, the inorganic sulphate sulphur was most variable and, as shown by Folin, increased or decreased in absolute amount with the increase or decrease in the urea excretion (25). Both urea and inorganic sulphates are reduced to a striking degree when there is a diminution in the total protein metabolism. As the total sulphur is reduced, the per cent represented by inorganic sulphates sinks from about 90% to less than 60%.

Urea nitrogen percentage of total nitrogen shows a similar diminution when the total nitrogen is diminished. These are of twenty-four hour amounts. There is no evidence to show that in individual specimens, inorganic sulphur and urea quantities must always be comparable. The conjugated or ethereal sulphates have usually been considered as products formed in the detoxication of the toxic phenol and indol derivatives of bacterial origin in the intestine.

Unoxidized or neutral sulphur, whose origin is not understood, is more constant in amount than either of the other two sulphate fractions. Folin called attention to this fact and suggested that the neutral sulphur was associated with some process of endogenous metabolism, and was as truly characteristic of endogenous metabolism as is creatinin.

There is little evidence of specific pathological changes in sulphur metabolism in disease. Inasmuch as the greater part of the sulphur of the urine is present as inorganic sulphate and is related to the urea nitrogen in the processes of catabolism of protein, any change in protein metabolism in disease must of necessity involve a change in the sulphate sulphur formed and eliminated. This is a general alteration in protein metabolism rather than a specific change in sulphur metabolism. The examinations for sulphates which we have made in the urine have been entirely as regards inorganic sulphate sulphur. The test is made by adding 3 drops of an acidulated Barium-chloride solution to about 1 cubic cc. of urine. Approximate estimation is made as follows: If a simple opaque, milky turbidity result, the sulphates are present in about the normal amount; if more opaque, possessing the appearance of cream, the sulphates are recorded as increased; if but a slight translucent cloud result, the sulphates are diminished. Our mortality as far as sulphates are concerned is essentially normal and will be discussed later.

Chlorides. We also investigated the effect of varying amounts of chlorine in the urine. Sodium chloride with urea forms the chief solid constituents of the urine upon which its specific gravity depends.

The chlorine occurring in the urine is combined with the bases contained in this excretion; the chief part being in combination with sodium; the balance with potassium, calcium, magnesium and ammonia. In accordance with this, the quantity of chlorine in the urine is generally expressed as NaCl. Chlorides are excreted mainly through the kidneys. A small portion is excreted through the skin and intestines, but this is so

small that it may be disregarded in healthy persons. In diarrhea, however, it may increase a great deal. In general, the amount of NaCl excreted from healthy adults on a mixed diet is 10 to 15 grams per twenty-four hours. Under physiological conditions, chlorides are excreted rapidly (3). Ten to fifteen grams are as a rule excreted in two or three days. The chlorine of the urine depends chiefly upon the amount of salt in food with which the elimination increases and decreases. The free drinking of water increases the elimination of chlorine which is greater during activity than during rest. Wolferth (26), studying blood-plasma chlorides, showed that NaCl added to the diet is sometimes excreted as completely by impaired kidneys working under the stimulation of a high chloride content of the plasma as by normal kidneys working under normal chlorine threshold; added chlorine may be retained when the threshold is normal. The chlorine excreting function is impaired in nearly all cases of nephritis, and is much more disturbed in eclampsia than is urea excretory function. Frothingham (27) by a study of forty cases of chronic nephritis found that thirty-nine of the forty cases showed impairment of ability to excrete salt if increased beyond minimal requirements. Austin and Jonas (28) showed that in certain nephritic animals with impaired chlorine excretion, whatever may be the hypothetical chloride threshold, a given increment in the plasma chloride concentration excites less increment in the rate of chloride excretion than it would in a normal animal.

Owing to the ability of the organism to keep the osmotic pressure constant, there is an intimate correlation between chlorine and water metabolism (29). In disturbances of gastric secretion (30) there is an

increase in chloride elimination in cases of hyperacidity. Conversely, chlorides may be diminished in cases of hypoacidity. Retention of chlorides may be indirect owing to retention of water, which, due to osmotic pressure, is followed by retention of chlorides. This would explain salt retention in cardiac decompensation. The cause of chloride rentention in fever is not known. The chloride retention in pneumonia is well known, but where the chlorides are accumulated is not known. In cachexia, diminution of chlorine output may be due to diminished intake of food or to edema and transudates, in which cases the plasma chlorides are normal. Little is known regarding the diminution of chlorine in the organism.

The test used is the familiar one of adding a drop of Ag No_3 12% to urine which has been rendered acid with HNO_3. The white precipitate silver chloride judged by its density gives us our reading. Personally, I have found the reading to be normal in all urines whose gravity has been 1.015 or above. The test is more for detection of the presence of chlorides than for their concentration.

Our mortality according to the concentration of chlorides was 61.25% and will be discussed in relation to weight groups.

Urea. It would appear from the literature that interest in the matter of urinary urea has taken second place to interest in blood urea concentration, and there is no information in recent literature based on the method which we use. The consensus of present opinion appears to be well summed up in Christian's statement "except for albumin, glucose, casts and cells, specific gravity and amount, little else can be learned from the study of the urine" (11).

In 1903, it was decided to require, before considering a specimen of urine normal, that it should contain at least 1.7% of urea, irrespective of the gravity, on which a limit of 1.020 was set. In this way a "load" was applied to renal function; namely, an applicant must be able to pass a urine with a concentration of urea at least 1.7% which was normal in all other respects. Whether or not you admit that this was rational empiricism, the results would appear to justify the means.

When we examine our policies according to the urea percentage alone, we find, in general, the mortality is the same, slightly above the company average mortality, except where the urea is between 1.75% and 2.00%. Where the urea is higher than 2.00% or lower than 1.75%, the mortality is several points poorer. Nephritis is well below the average in all, while heart disease and circulatory diseases are high.

To summarize, the mortality, where the urea was less than 1.75%, was 61.77%. Where the urea was 1.75% and over, it was 60.45%. It might appear that urea determinations were of little use, but when we come to consider them in relation to specific gravity, circulatory impairments and heavy weights, their value will be obvious.

Phosphoric Acid appears in the urine in two general forms: First, that in combination with the alkaline metals, sodium and potassium and the radical ammonium. Second, in combination with the alkaline earths, calcium and magnesium. Phosphates formed through a union of phosphoric acid with the alkaline metals are termed alkaline phosphates, whereas phosphates formed through a union of phosphoric acid with the alkaline earths are termed earthy phosphates. The

excretion of phosphoric acid is extremely variable but on the average the total output for twenty-four hours is about 2.5 grams expressed as P_2O_5 and ordinarily the total output is distributed between alkaline phosphates and earthy phosphates approximately in the ratio 2:1 which is merely another way of saying that sodium and potassium are twice as great in amount as are calcium and magnesium.

The greater part of this phosphoric acid arises from ingested food either from the preformed phosphates or more especially from the phosphorus in organic combination such as we find it in phospho-proteins, nucleus-proteins and lecithins (31).

The amount of phosphates in the urine bears a direct relation to the amount of food ingested, and are converted from the organic compounds into inorganic phosphates. Only a very small amount of phosphorus is excreted in the urine in organic combinations (32).

Dowd (33) states that the earthy phosphates have no clinical significance. The alkaline phosphates represent the end products of nerve cell nutrition, although he admits that certain foods rich in phosphorus increase them. The elimination of alkaline phosphates varies during the twenty-four hours. It is lowest at ten o'clock in the morning and rises during the day to a maximum in the evening.

Alkaline phosphates ingested with food have a greater tendency to increase the phosphoric acid content of the urine than do the earthy phosphates so ingested, due in a measure to the fact that a portion of the earthy phosphates under certain conditions may be precipitated in the intestines and excreted in the

feces. Since this is true, there can be no absolute relationship between the urinary output of nitrogen and phosphorus.

Pathologically the excretion of P_2O_5 is increased in such diseases of the bone as diffuse periostitis, osteomalacia and rickets, early stages of phthisis and in acute yellow atrophy of the liver, in diseases which are accompanied by an extensive decomposition of nervous tissue, after sleep induced by potassium bromide or chloral hydrate and after copious water drinking. Hawk states that "phosphaturias" may at times represent decreased acidity and not increased phosphate content.

Embden and Grafe (34) noted an increase in phosphate excretion after prolonged strenuous exercise, and this is corroborated by Havard and Reay (35) who add that this increase is followed by suppression in some cases. They have showed that the rate of phosphate excretion is independent of the water rate even with copious water diuresis.

Salvesen, Hastings and McIntosh (36) by the administration of phosphates produced definite tetany which is due to a reduction of blood calcium.

Addis, Meyer and Bayer (37) in a series of experiments on rabbits using intravenous injections of a neutral solution of sodium phosphate, so that all variations in the phosphate concentration of the plasma were consonant with freedom from tetany, concluded that the urinary rate of excretion of phosphate varies as the plasma concentration.

H. Bierry (38) concludes that the rate of excretion of phosphates is primarily influenced by metabolism of carbo-hydrates and not by the metabolism of proteins. During the period of hypoglycemia after insulin it appears as if there was a temporary combination of the

glucose and phosphoric ion. However, Kolodziejska and Fund (39) feel that insulin plays an insignificant role in phosphorus metabolism.

Haldane, Wigglesworth and Woodrow (40) showed the the ingestion of large amounts of ammonium chloride was followed by an increase to the rate of phosphate excretion.

A decrease in the excretion of phosphates is noted at times in febrile conditions such as acute infectious diseases, in pregnancy when the fetal bones are forming and in diseases of the kidneys because of non-elimination, although the ability to excrete phosphorus is one which is not readily lost.

The tests for phosphates which we use are purely qualitative.

In testing for earthy phosphates we add to half a test tube of filtered warm urine a few drops of dilute ammonium hydrate, enough to render it alkaline. The degree of cloudiness produced gives an arbitrary ruling as to the amount. A very faint cloud is considered as meaning decreased earthy phosphates. A heavy cloud is read as increased earthy phosphates, the normal lying between the two.

In testing for alkaline phosphates we add to half a test tube of warm filtered urine a few drops of magnesia solution and read the degree of cloudiness as representing decreased, normal or increased alkaline phosphates.

Magnesia Solution. Magnesium sulphate, ammonium hydrate, ammonium chloride of each one part; water eight parts.

Our mortality according to the concentration of earthy phosphates was 61.97%, while that according to the alkaline phosphates was 61.65%.

Where either earthy or alkaline phosphates were recorded as normal, which was the case in the very great majority of the determinations, there is no appreciable deviation from the mortality of the general group.

When earthy phosphates were studied according to the urea concentration, the mortality was 67.28% with urea less than 1.75%, as compared to 61.42% where the urea was 1.75% or over.

Urea concentration had no apparent effect upon the mortality when studied along with alkaline phosphates.

The effects of these various urinary solids have been studied in relation to weight groups, and will be discussed under those headings.

Sugar. Individuals who so far as we know have shown sugar in the past are required to submit to a blood sugar tolerance test, as outlined by McCrudden (41). Acceptance is based on the blood sugar reading irrespective of the presence or absence of sugar in the urine.

Creatinin. As a measure of endogenous metabolism we have recently determined the creatinin content of specimens otherwise normal, whose urea has been relatively low compared to the specific gravity. It is too soon to report our results, except to say that in about 50% of the specimens so examined the results have been acceptance of the risk by the company, thus obviating the difficulty of getting more specimens. For a complete discussion of this subject I would refer you to McCrudden (42).

The following table is the one we use in making our decision as to the creatinin concentration since a preliminary study showed apparently a relationship between creatinin concentration and height.

Creatinin in mg. per 1 cc. Urine	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8	5-9	5-10	5-11	6-0	6-1	
	124	128	132	136	140	144	150	156	162	168	174	180	186	
	Twenty-four hour amount in cc.													
0.50	2480	2560	2640	2720	2800	2880	3000							
0.60	2070	2130	2200	2260	2320	2400	2500	2600	2700	2800	2900	3000		
0.70	1770	1830	1890	1940	2000	2060	2140	2220	2310	2400	2500	2570	2650	
0.80	1550	1600	1650	1700	1750	1800	1880	1950	2020	2100	2180	2250	2320	
0.90	1380	1420	1470	1510	1560	1600	1670	1730	1800	1860	1930	2000	2060	
1.00	1240	1280	1320	1360	1400	1440	1500	1560	1620	1680	1740	1800	1860	
1.10	1130	1160	1200	1230	1270	1310	1360	1420	1470	1530	1580	1640	1690	
1.20	1030	1070	1100	1130	1170	1200	1250	1300	1350	1400	1450	1500	1550	
1.30	950	980	1010	1040	1080	1110	1150	1200	1250	1290	1340	1380	1430	
1.40	880	910	940	970	1000	1030	1070	1110	1160	1200	1240	1290	1330	
1.50	830	850	880	910	930	960	1000	1040	1080	1120	1160	1200	1240	
1.60	780	800	820	850	870	900	940	970	1010	1050	1090	1120	1160	
1.70	730	750	780	800	820	850	880	920	950	990	1020	1060	1090	
1.80	690	710	730	750	780	800	830	870	900	930	970	1000	1030	
1.90	650	670	700	720	740	760	790	820	850	880	910	950	980	
2.00	620	640	660	680	700	720	750	780	810	840	870	900	930	

MORTALITY INVESTIGATION BY THREE GROUPS OF WEIGHTS

More than 20% Underweight.
20% Underweight to 20% Overweight, inclusive.
More than 20% Overweight.

Years of Issue	Without Examination by Chemist 1844-1905	With Examination by Chemist 1903-1921	Percentage of Improvement
1st group	79.79%	53.57%	32.86%
2nd group	76.55	55.73	27.20
3rd group	107.47	91.01	15.32
Total	79.05%	60.56%	23.39%

Average Mortality Total Business 1903-1921, inclusive, 55.00%.

Let us now consider the influence of selection on these weight groups. As you will see from the above table, in the lightweight group our experience during these years is entirely satisfactory, and indicates a very radical improvement. Deaths from pulmonary tuberculosis, pneumonia, appendicitis and peritonitis were what would naturally be expected among extreme lightweights. The low death rate from circulatory disease and nephritis is interesting considering the fact that large numbers of these cases presented a history of what was suspicious of circulatory disease and nephritis.

Our experience with those between 20% underweight and 20% overweight, the largest group, is entirely satisfactory, being but 73/100 of 1% higher than our average experience of all business done during the same period of years. The death rate from circulatory disease is quite high, but in mass the results are all that we could expect.

Our experience with those more than 20% over-

weight is not as good. The general chart shows that up to age 50 our experience has been almost exactly that of the American Men's Table, but that after 50 it is considerably higher. The increase in deaths comes from cancer and circulatory diseases as the weight goes up, while nephritis has apparently been eliminated. It must not be forgotten that since we are dealing with percentages, as the mortality drops from one cause, it must necessarily rise from other causes. While we have controlled one factor, nephritis, as a cause of death, we have not so satisfactorily improved the general mortality of the group. It is reasonable to suppose since nephritis has been eliminated as a cause of death, that this elimination represents the improvement which has been brought about in the mortality of the overweights. However, in the hope of finding some common factor as another cause of the excessive mortality among overweights we have studied these three weight groups in their relation to various urinary constituents. First, we have examined them with reference to the percentage of urea in the specimen on which acceptance by the company was made. Taking the overweights, we divided them into two groups, those with urea less than 1.75%, and those with urea 1.75% and over. The mortality was found to be excessive in each group. However, it is 24% higher where the urea is less than 1.75%. With the greater concentration of urea, there is a tendency for this mortality to become a later-life one.

The causes of death, heart disease and circulatory disease, are the same as in the general group of overweights with a strikingly low percentage of nephritis, and an equally striking increase in deaths from cancer. While deaths from heart disease and circula-

tory disease are high in each, they are considerably higher where the urea is 1.75% and over. It is apparent that the better mortality with urea above 1.75% which was found in the general investigation of urea still obtains where overweights are concerned.

When we investigated our cases according as to whether sulphates were normal, increased, or diminished we found the same general mortality, which is a satisfactory one, in each subdivision as well as in the entire division where sulphates had been recorded. Nephritis is well below the average in each group except where the sulphates are diminished, and in this group it is twice as high as in the other groups.

When we subdivided these cases where sulphates were recorded into two groups with urea less than 1.75% and 1.75% and over, we found that the general mortality with urea less than 1.75% was 64.78% as compared to 61.83% where the urea was 1.75% and over. Where the urea is less than 1.75%, sulphates normal, the mortality was 64.44%. With the urea 1.75% and over, sulphates normal, the mortality was 62.16%. The groups with sulphates increased or diminished were not large enough to warrant drawing conclusions. The chief point here is the slight increase in mortality percentage with the lower urea, and the paralleling of the mortality for the group where the sulphates are normal.

Studying the group of overweights with urea divided into two groups, urea less than 1.75% and 1.75% and over with the sulphates normal, we find a mortality which is some forty odd per cent better where the urea is 1.75% and over (82%-126%). While the mortality of this group is much higher than the mortality of the general group where sulphates are

normal (reflecting the higher mortality of overweights), it compares favorably with the mortality of overweights (91%) as an entire group or as a group of overweights with urea 1.75% and over (88%).

The groups with urea less than 1.75% and 1.75% and over, with sulphates increased or diminished, did not afford sufficient cases to warrant drawing a conclusion.

Apparently the quantity of sulphates has no appreciable effect on mortality when taken by itself or on the mortality of overweights.

When we examined our cases according to concentration of chlorides, we found a general mortality of 61.25% which is satisfactory. Where the chlorides were recorded as normal, the mortality is 59.34%. Where the chlorides were diminished or increased, the numbers were relatively too small to be of service.

Now, dividing these chlorides into two groups with urea less than 1.75% and 1.75% and over, we found that in the former instance, the general mortality is 63.30%. Whereas, in the latter, it is 61.02%. With chlorides normal, with urea less than 1.75%, the mortality is 61.02%. With the urea 1.75% and over, chlorides normal, the mortality is 59.15%. The same remarks hold true here as they did in regard to sulphates, that is to say, a slight betterment of mortality with the urea 1.75% and over.

When we consider the effect of chlorides combined with urea in the mortality of overweights, we find that where the urea is 1.75% and over, chlorides normal, that the mortality is 93.05% as compared to 119.81% where the urea is less than 1.75% with the same concentration of chlorides, reflecting the effect of

overweight because the general mortality with normal chlorides is entirely satisfactory. It would appear that chlorides are not a factor in determining mortality.

When we study the effect of earthy phosphates combined with urea, in the mortality of overweights, we find a mortality of 112.46% where the urea is less than 1.75% earthy phosphates normal, as compared to 82.52% where the urea is 1.75% and over, representing the beneficial effect of a high urea upon overweights since the general mortality where the earthy phosphates are normal, is essentially the same whether the urea is less or more than 1.75%.

In this same overweight group with urea less than 1.75%, alkaline phosphates normal, we find a mortality of 114.46%, as compared to 87.89% where the urea is 1.75% and over with the same concentration of alkaline phosphates.

Normal Weights: Let us consider the group of so-called normal weights, that is 20% underweight to 20% overweight. This group is also divided into classes with varying percentages of urea and the mortality is quite satisfactory except where the urea is less than 1.75%. In fact, in each other group the mortality is below the company average. The chief causes of death are heart and circulatory disease. Nephritis is well below the average except where the urea is less than 1.75% when it is slightly above average.

Subdividing this group into two classes with the urea less than 1.75% and 1.75% and over, the mortality is essentially the same in each group, and is satisfactory. Nephritis is slightly above the average where the urea is less than 1.75% and well below the average where the urea is 1.75% and over. Considering this same group of normal weights divided into groups where the

urea is less than 1.75% and 1.75% and over, according to the concentration of sulphates, we find that with the urea under 1.75%, the mortality is essentially the same as for the general mortality of this weight group, which is satisfactory. There are no deaths from nephritis in this group. When this group was examined with urea 1.75% and over, according to sulphate concentration, there was no essential change in mortality and in this group, also, nephritis is well below the average. When the group of normal weights was studied with reference to the concentration of chlorides, with urea under 1.75% and over 1.75%, we find that the mortality, where the urea is less than 1.75% and chlorides normal, is satisfactory. With this concentration of urea, but with chlorides either increased or diminished, although these two groups are rather small, there is a sharp rise in the mortality rate. These two groups show no deaths from nephritis, although this cause is some 4% above average where the chlorides are normal. Now, considering the group of normal weights with urea 1.75% and over, with chlorides increased, normal, and diminished, we again find that with the chlorides increased or diminished there is a sharp rise in mortality as compared to the mortality where the chlorides are normal. Nephritis is well below the average in this group. To repeat, irrespective of the urea concentration where the chlorides are normal (it must be remembered that the number of cases where the chlorides were normal compared to the number of cases where chlorides are increased and diminished, whether the urea is above or below 1.75% is as five to one so that the high mortality with chlorides increased or diminished must not be considered too seriously), the mortality is that of the entire group of normal weights.

When we consider the normal weights according to urea concentration and earthy phosphates or alkaline phosphates, we find, where these are normal, no appreciable change in mortality whether the urea is less than 1.75% or more. The mortality in each instance is entirely satisfactory.

Apparently phosphate determinations helped us not at all in this group.

Underweights: When this group is studied according to the urea concentration, the mortality is satisfactory where the urea is 1.75% and over, and is 24% less than where the urea is below 1.75%. The causes of death are as in the general underweight class. Nephritis is absent.

When we examine this group of underweights with urea less than 1.75% and 1.75% and over, with varying amounts of sulphates, the classes were too small to warrant drawing conclusions. It is worthy of note, however, that there were no deaths from nephritis in either class.

Examining these same underweights according to urea percentages and varying amounts of chlorides, where the urea is 1.75% and over, chlorides normal, the mortality is considerably below average (44.39%). Where the urea was less than 1.75%, chlorides normal, the group was not large enough to be considered. However, in neither class was there a death from nephritis.

Studying underweights according to urea percentages and concentrations of earthy or alkaline phosphates the classes are very small and the only observation worthy of note is the trend towards a better mortality where the urea is 1.75% and over.

To recapitulate according to weight group, take the three weight groups with urea under 1.75%. The

mortality is normal with the normal weights, much above normal with the underweights and very much higher with the overweights.

Take these same groups with the urea 1.75% and over. The mortality is still normal with the normal weights, normal also with the underweights, but above normal with the overweights; *i. e.*, 88% as compared to 112% where the urea is less than 1.75%, a difference of twenty-four points. There is also a twenty-four point increase in mortality with the underweights where the urea is below 1.75% as compared to the group of underweights where the urea is 1.75% and over. It would appear that the urea percentage has more effect upon the mortality of overweights and underweights than it has upon the normal weights, and its importance in the improvement in mortality shown since urinalyses were made by chemists, cannot be overestimated. It is the only one of the urinary solids whose estimation has been productive of tangible results.

Summary

The general mortality for the entire group of so-called impaired risks is satisfactory.

Nephritis has practically been eliminated as a cause of death. It is, however, above average in certain groups, such as that with a personal history of hematuria, also in the group with a personal history of albumin and casts where the specific gravity was below 1.021. It is worthy of note that there is a general increase in deaths from nephritis where the gravity is below 1.021, although in no instance is this excessive. This increase in deaths from nephritis and in general

mortality where the specific gravity is below 1.021 coincides with the clinical views on low gravity urine.

While the mortality is satisfactory as a whole there is an unmistakable trend toward excessive mortality whenever we deal with

Overweights,
Groups where there are circulatory impairments,
Groups where the specific gravity is below 1.021,
Groups where the urea is less than 1.75%,
Groups where the urea is more than 2.00%.

When the groups were studied in relation to specific gravity and urea, where this specific gravity is less than 1.021, the mortality is variable, being lowest where the urea is between 1.75% and 2%. It is higher where the urea is less than 1.75% and slightly higher still where the urea is over 2%. The tendency has been noted towards increased mortality where groups were examined whose urea was more than 2%. Where this specific gravity is over 1.021, the lowest mortality is again where the urea is 1.75% to 2%, the lower and higher ureas giving a less favorable mortality. It is comparatively easy to understand the higher mortality with a low concentration of urea. It may be that the increased mortality where the urea is over 2% is in part the increased mortality which in general accompanies deviations from the average.

By superselection we controlled the mortality for a given group.

The group with a personal history of albumin, when the specimen on which acceptance by the company was made had a specific gravity above 1.021, showed no greater mortality than did the group with a personal history of no albumin.

A personal history of casts did not in general increase the mortality. However, the mortality with this group was excessive when the specific gravity was below 1.021.

The amount of NaCl in the urine had no appreciable effect on mortality.

The amount of sulphates in the urine had no appreciable effect on mortality.

The amounts of either earthy or alkaline phosphates gave us no information of value.

Some Suggestions for the Future

The estimation of amounts of chlorides, sulphates, earthy phosphates and alkaline phosphates has rather generally been abandoned, presumably, because of the general "impression" that their estimation was of no value. We believe we have offered sufficient proof of the uselessness of estimating them in our work and it is our intention to discontinue estimating and recording them.

We have for other reasons decided to eliminate estimations of uric acid and the test for the presence of acetone. We will no longer require an opinion on the consistency of the specimen.

I believe I am correct in saying that the estimation of urea percentage in single specimens of urine is looked upon by most companies as not worth the doing. We have continued to do it and we propose to maintain that practice in view of the investigation we have made. Without exception, in any class where there is expected an increased mortality, this mortality has been less where the urea concentration in the specimen upon which acceptance was based, was 1.75% and over.

Why should we not insist that members of this class, where increased mortality is to be expected, furnish us with a specimen of urine which will contain this amount of urea and be otherwise normal?

As a further check upon the metabolism of the applicant, we propose to make a quantitative examination of creatinin.

Since our mortality has shown an unmistakable trend to rise in those groups where the specific gravity of the specimen was below 1.021, we have ample reason for demanding that the applicant be able to pass a normal urine whose gravity shall be at least 1.021, particularly if he belongs to any of the groups with an expected increase in mortality.

By our present methods of studying cases with circulatory impairments, we expect to control adequately the mortality where these impairments are presented.

While we have controlled the general mortality with overweights we are not satisfied. We have eliminated nephritis as a cause of death, but we have not made any impression upon circulatory deaths in this group. Since the principal cause of death in this group is from circulatory disease, we propose to apply our measure of circulatory stability upon the more doubtful of the overweight applicants.

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Dr. Beckett—I will ask Dr. J. Keith Gordon of the Sun Life to open the discussion on this paper.

Dr. Gordon—This paper of Dr. Brown's is a rather difficult one to discuss because he has so completely and comprehensively covered the subject that there is little left for me but repetition, and I am forced, therefore, to simply emphasize what seem to me to be some of the more important points.

Dr. Brown has produced both positive and negative evidence that there is an association between certain observations made in urinalyses by the chemists of the company which he represents and the mortality of the large group of cases. Negative findings have a very definite place in our scientific literature, particularly when they are of a confirmative nature, and in this instance it is to our great benefit to have the general belief confirmed that the quantitative estimation of sulphates, earthy phosphates, and alkaline phosphates in the urine, is of academic rather than practical value.

Those companies which heretofore have paid particular attention to these substances may now safely discontinue the practice and devote their attention to more important matters.

It is in regard to some of the positive findings—namely, that the mortality varies directly both as the precentage of urea in the urine and the specific gravity of the urine, that I would particularly like to make a few remarks, purely from the clinical aspect.

No one will deny that, provided individuals can be observed under standard conditions, the determination of the amount of urine urea is of great value in estimating the functional capacity of the kidney. For example, if a fasting individual is given a certain amount of urea with water, by mouth, and one and two hours later, estimations are made of the amount of urea in the urine, a very good idea of the kidney's capacity to perform its chief function is obtained. If this is combined with the Mosenthal meal, which consists of reading the specific gravities of the component parts of a twenty-four hour specimen, with the individual again under standard conditions, a very complete picture of kidney function is obtained. On the surface it would appear that the estimation of the urea in the urine of the applicants for life insurance is of little value, because the urines are obtained at varying times of the day and under extremely variable conditions. As a matter of fact, by far the greater number of applicants are examined in the middle of the day, and from one to two hours after having eaten a heavy meal; and when the theory of statistics is applied to a large series of cases, such as Dr. Brown has quoted, there can be no dispute about the figures obtained. There is just one precaution that

should be followed, and that is in regard to the method used in determining the amount of urea in urine. It has been said that the older hypobromite method is inaccurate, and that it will at times give an inaccurate reading of as much as 25%, while it is generaly accepted that the urease method is one which can be absolutely depended upon. The latter method is, however, rather complicated for the practical purposes of a life insurance company's laboratory.

The specific gravity readings are of the greatest importance in determining whether or not an individual has a damaged kidney. Fixation of the specific gravity at a low level may be taken in general as a sign of the presence of nephritis. That implies, of course, that two or three urines must be examined before a conclusion can be reached. However, as an aid to diagnosis, it has the advantage over all the other tests that we apply to urine, in that the reading of a specific gravity is so simple that any technician can perform it without error. It is an uncomplicated foolproof test of renal efficiency that we are too much inclined to overlook in place of the presence of albumin, casts, and other elements, which to us, as medical men, have a greater objective interest.

I notice that Dr. Brown is going to continue estimating the amount of creatinin in the urine. Now, creatinin is a product of metabolism, which is one of the very last to be retained by a damaged kidney. Since it is the problem with us to detect early kidney impairments in order to eliminate nephritis as a cause of death, it would scarcely seem to be worth while bothering about a substance which is only dimished in the urine of a patient who is really in extremis.

Dr. Beckett—Is there anyone else who would like to discuss this subject? Dr. Muhlberg.

Dr. Muhlberg—Unfortunately, I haven't had the time like most of you to read over this paper of Dr. Brown, but of course we all very highly appreciate that work of this nature is very necessary if we are going to make any progress in medical selection.

Dr. Brown made a statement that interested me a great deal, namely, "We have for other reasons decided to eliminate estimations of uric acid and the test for the presence of acetone." I am interested in that because for the past ten years we have been playing around the examinations for acetone, qualitative and quantitative tests. Unfortunately, the old qualitative test is not very satisfactory. In order to derive any information from the urine, one must determine the quantitative amount of acetone in the urine. We have, I believe, discovered a qualitative diacetic acid test that is very easy to apply, and I think is much better than the older test, and we are also working at the present time on a quantitative test for acetone that is no more difficult to apply than is the present picramic acid test for sugar.

As a preliminary work, we have been examining the normal acetone contents of normal urines and we find that the amount of acetone in the urine—I think we studied some 100 to 200 cases—is really only about 1 milligram per 100 cc. On the other hand, the abnormal cases will run 20, 30, 40 and up to 100 milligrams per 100 cc. The only reason we are working on the estimation of acetone is this: There are about, a million diabetics in this country. A great many are under treatment. I personally have had under observation for some years mild diabetics who have a sugar tolerance of about 100 to 200 grams of carbohydrate a day. Every one of those persons can pass a sample

of urine that practically never shows more than .2 per cent of sugar, and yet I have never been able to obtain a sample from them that did not contain more than the normal quantity of acetone. We are all perplexed, I think, at times to know just what to do with minute traces of sugar. I think most companies accept up to .2 per cent and many of them accept up to .3 per cent. Our own practice is to accept up to .3 per cent in a single sample, but where a sample shows, say, between .2 and .3 per cent and there is likewise more than a trace of acetone in the urine, I believe it is a wise precaution in such cases to call for a glucose test, because I have no doubt that there are very many mild diabetics that are slipping through.

You will remember that Dr. Rogers presented some figures to the Association last year, or the year before, that even .2 per cent of sugar in the urine is of considerable significance and that the mortality from the diabetics in those cases was considerably above the normal. So I really think that it is a mistake to discontinue studies of acetone. I believe the majority of diabetics know how to diet themselves and can send us specimens that will show no more than .2 per cent of sugar. I think more of the samples will show more than 10 or 20 milligrams per 100 cc. of acetone in their urine and in such cases I think we can safeguard ourselves by calling for a dextrose test of 100 grams of a glucose test, and I doubt whether even a mild diabetic can successfully pass that test. I would like to see the New England Mutual continue the acetone test—all the companies—because I really believe that the data we will derive in that way will be of service to us in discriminating among these cases that show only traces of sugar in the urine.

Dr. Beckett—Is there anyone else that would like to speak on this subject? If not, I will ask Dr. Brown to close the discussion.

Dr. Brown—Replying to Dr. Gordon's skepticism as to the accuracy of the sodium hypobromite method of urea determination, Mosenthal reports in Medical Clinics of North America, 1920, that in his studies on test meals, the hypobromite method for urea determination was entirely adequate from a clinical point of view, contrary to the general supposition. He cites a table of comparative values for total nitrogen in the urine by the Kjeldahl and hypobromite methods. The results agree very closely.

Regarding creatinin, I would again refer you to Dr. McCrudden's article for a complete discussion of the subject. We are not interested at present in the specimens which have a low concentration of creatinin. Rather we are concerned with those urines with a low urea and normal concentration of creatinin. Where other factors, apart from urea, are satisfactory, and the creatinin is sufficiently concentrated, we are accepting the specimen as normal. The question of diminished content of creatinin is not pertinent at present, although, as a routine, we are making creatinin determinations on all specimens.

In reply to Dr. Muhlberg, I would say that our method of estimating the amount of uric acid in the urine was found to be unsatisfactory, and that is the reason for its discontinuance.

In so far as acetone is concerned, since the acceptance or rejection of all cases which have shown sugar in the urine by Benedict's or Fehling's methods is based upon the blood sugar concentration, two hours after the ingestion of 100 grams of dextrose, its esti-

mation has been of minor importance so far as we are concerned. Moreover, the test which we had used was purely the qualitative one, and we are now making only the Ferric Chloride test for diacetic acid.

I would like to add a few words regarding casts. The results contained in my paper were not based upon the number of casts, but merely upon their presence. Since the paper went to the printer, further investigation regarding the presence of hyaline or granular casts has shown a much better mortality percentage in those cases where there was a personal history of many hyaline or granular casts than it was in those cases which showed only rare casts. It is not unreasonable to suppose that this may be interpreted as showing that numerous casts represent an acute process from which the applicant entirely recovered. Presumably, where casts were rare, the condition was one of a chronic type in which, as you know, casts are notoriously inconstant.

Dr. Beckett—Our next paper will be one entitled, "Progress in Quantitative Laboratory Methods" by Dr. Kingsbury.

PROGRESS IN QUANTITATIVE LABORATORY METHOD

by F. B. Kingsbury, Ph. D.
Metropolitan Life Insurance Company.

My subject again concerns the technique of the laboratory with special reference to the further application of the quantitative principles which have proved so satisfactory since their first application in our laboratories by Doctors Folin and Benedict, a few years ago. In the first place, it may be said that the quantitative chemical methods have introduced a new foundation, of much greater strength than the old upon which to base the study of urinary impairments. Now, the question arises as to the feasibility of applying these principles to the examination of sediments, a procedure which is subject to much more variation from individual differences in judgment than are the chemical methods.

Our work shows that it is feasible to carry on our sediment examinations in a more quantitative fashion, but before taking up the method of accomplishing this in detail it will be necessary to describe briefly our old method of sediment examination.

The chief difficulty with our present system of sediment examination is in the uncertainty of ascertaining just how much urine the fraction of sediment examined really represents. According to our instructions the technician dips a pipette tip into the sediment, attempting to get the sediment from three places, the top, middle and bottom in order to obtain a fair sample. A certain undetermined amount of urine runs up into the pipette diluting the sediment in this

way preventing the obtainment of a true aliquot part. The technician then transfers one large drop of sediment or two small ones to a 3″ x 1″ glass slide, covers the sediment with a 7/8″ square slip and examines the whole area under the cover slip for casts, the use of a mechanical stage greatly facilitating this procedure. The volume of sediment and urine so transferred to the slide is from 0.05 to 0.075 cc. according to our estimate of the meaning of one "large drop or two small ones." If ten casts are found and reported, how much urine were they originally present in? It is impossible to say, primarily, because we do not know what proportional part of the whole sediment was actually examined. In order to determine this one must know the volume of the whole sediment and then in some way transfer a known part of it to the slide. The volumes of sediment are often too small to be readily measured, but by diluting the sediment with urine and thoroughly mixing a convenient volume is obtained from which a proportional or aliquot part may then be taken for examination.

The principle is simple enough, but the details of dilution must be so worked out that the method when finished will be just as adequate in determining small numbers of large objects such as casts, as in determining the leucocytes and red blood corpuscles, which because of their minute size lend themselves much better to an even distribution on the dilution of the sediment.

The Method

15 cc. of urine, or 10 cc. if more convenient, are poured into the specially designed centrifuge tube such as I hold in my hand and centrifuged for 5 minutes at

2,000 R. P. M. The urine is then carefully poured off. A little runs back into the tube diluting the sediment. After a few seconds' delay to allow the draining to be completed, the volume of the diluted sediment is noted. Sufficient urine, a few drops, is added to bring the volume to 0.4, 0.5 or 0.6 cc. With practice the technician can omit this last step for he will get the necessary volume from the drainings when he first pours off the urine. A pipette such as I hold in my hand, graduated to deliver 0.05 cc. or 0.10 cc. is now used to transfer the diluted sediment, 0.05 cc. or 0.10 cc. of the diluted sediment to the slide, and the latter is then covered with the cover slip and examined in the usual way. If the sediment had originally been diluted to 0.6 cc. which is a convenient volume in most cases, 0.05 cc. would be one-twelfth, or 0.10 cc. would be one-sixth, the factors to be used later in making the report. As an example 15 cc. of urine were originally taken, the sediment was diluted to 0.6 cc., 0.05 cc. were placed on the slide and 5 granular casts were found. Since the 5 granular casts were found by examining the whole of the 0.05/0.60 portion of the sediment it is obvious that there were in the whole sediment 12 times as many or 60 granular casts. Since the sediment was obtained from 15 cc. of urine there were 60 granular casts in 15 cc. of urine.

Similarly if 25 leucocytes were found as the average number per high power field when at least 20 fields had been examined there would have been 25 $\times$ 12 or 300 leucocytes per high power field if the undiluted sediment of 15 cc. of urine had been examined. This does not give us the absolute number of leucocytes per unit of urine volume but it does give us the average number of leucocytes per high power field under con-

ditions that are constant, so that if less urine than 15 cc., say 10 cc., had been taken the average number of cells per high power field would have been 10/15 of the number found for 15 cc. since there would have been 10/15 of the amount of sediment, with a proportional part of which the estimation was made. Thus the number of leucocytes found can just as well be designated on this basis as to obtain the actual number, a tedious and laborious procedure, requiring a specially ruled slide, with a cell of known depth and a more complicated technique, similar to that used in blood cell counting.

The method just described has been tested for some months in a variety of ways in the laboratory against the older technique and the comparative data with casts, leucocytes and red blood corpuscles are shown below in tabular form.

It is obvious, I think, that by the old method in which the sediment is picked up by pipette that there is always an indeterminate amount of mixing of urine and sediment. The result is that the degree of dilution of the sediment actually transferred is not known nor is it known, of course, what proportion of the whole sediment is actually examined. Then the sediment is deposited more or less in layers according to the specific gravity and size of the objects present. The result is that one cannot get a representative sample of all layers as would be possible were the sediment diluted somewhat and thoroughly mixed. It is true, however, that with the old method the sediment is usually more concentrated than is the case with any of the various modifications of the new method, and that sediments diluted twice or three times as in the

new method, often have nearly the same number of objects when examined by the old method.

From this we would believe that the sediments are often diluted as much as three times in the old method, but we cannot be certain of this for it may in some cases be many times this. We do know, however, that an arbitrary dilution of three times in the new method will show casts if these are present in 17 out of 21 cases in which 3 casts were found by the old method. When 4 casts have been found by the old method they can invariably be found by the new method; even when the sediment is diluted ten times. These facts are brought out in Table I. Thus by the new method casts are certain to be found when they are present in numbers significant in life insurance work.

In Table II is shown a comparison of the casts found by the old and new methods with a few specimens of urine.

In Table III is shown a comparison of the new and old methods applied to the estimation of leucocytes and red blood corpuscles.

TABLE I.

New Method				Old Method	
Number of specimens	Number of specimens showing casts on slide (Diluted urine)	Volume of urine taken	Dilution	Number of specimens in which casts were found	Number of casts found
		cc.			
10	4	15	0.1. cc. of 0.3 cc. or 0.5 cc.	10	1
9	6	15	0.05 cc. of 0.6 cc.	9	1
5	4	10	0.05 cc. of 0.5 cc. or 0.6 cc.	5	1
26	16	15	0.05 cc. of 0.5 cc. or 0.6 cc.	26	2
4	2	15	0.10 cc. of 0.6 cc.	4	2
10	8	15	0.10 cc. of 0.6 cc.	10	3
2	2	15	0.5 cc. of 0.6 cc.	2	3
9	7	10	0.05 cc. of 0.5 cc. or 0.6 cc.	9	3
3	3	15	0.1 cc. in 0.6 cc.	3	4
4	4	15	0.05 cc. in 0.6 cc.	4	4
4	4	15	0.1 cc. in 0.3 to 0.7 cc.	4	5
7	7	15	0.1 cc. in 0.3 to 0.5 cc.	7	6-10
6	6	15	0.1 cc. in 0.5 to 0.7 cc.	6	11-25
3	3	15	0.1 cc. in 0.4 to 0.6 cc.	3	26-100 or more.

TABLE II.

New Method							Old Method
Volume of urine taken	Volume of diluted sediment taken	Total volume of diluted sediment	Dilution factor	Number of casts found on slide	Number of casts in 15cc. urine	Number of casts in 10cc. urine	Number of casts found
cc.	cc.	cc.					
15	0.10	0.30	3	0	0		1
10	0.05	0.40	4	1		8	0
15	0.10	0.35	3.5	1	4		1
10	0.10	0.60	6.0	1		6	2
15	0.10	0.30	3.0	0	0		2
15	0.10	0.30	3.0	2	6		2
15	0.10	0.40	4.0	3	12		2
15	0.10	0.30	3.0	1	3		3
15	0.10	0.35	2	2	6		4
15	0.10	0.65	6.5	1	7		5
15	0.10	0.30	3.0	6	18		8
15	0.10	0.30	3.0	8	24		10
10	0.10	0.60	6.0	8		48	10
10	0.10	0.60	6.0	5		35	11
10	0.10	0.60	6.0	16		96	18
10	0.10	0.60	6.0	6		36	24
10	0.10	0.60	6.0	60		360	54
10	0.10	0.60	6.0	338		2028	100

TABLE III.

Volume of urine taken	Volume of diluted sediment taken	Leucocytes — New Method: Total volume of diluted sediment	Dilution factor	Number of leucocytes found on slide Av. per H. P. F.	Number of leucocytes av. perH.P. F. for whole sediment	Old Method: Average Number of leucocytes per high power field
cc.	cc.	cc.				
15	0.10	0.3	3	15	45	6
15	0.10	0.39	3.9	7	27	7-12
15	0.10	0.32	3.2	8	26	9-15
15	0.10	0.60	6.0	17	102	20-30
15	0.10	0.63	6.3	26	164	30-40
15	0.10	0.60	6.0	25	150	50-60
15	0.10	0.65	6.5	35	228	50-60
15	0.10	0.47	4.7	35	160	50-80
15	0.10	0.37	3.7	70	259	80-90
		RED BLOOD CORPUSCLES.				
15	0.10	0.65	6.5	12	78	6
15	0.10	0.42	4.2	4	16	7
15	0.10	0.50	5	11	55)	
	"	"	"	10	50)	20-25
	"	"	"	10	55)	

SECOND PART

An Indicator for Glucose.

The use of sodium iodide to determine whether or not the glucose of a grape sugar test has been ingested offers a simple and harmless method for obtaining this quite necessary information. For the purpose of the test 0.10 gram of sodium iodide is mixed with 100 gram dose of glucose. It is to be noted that the amount of iodide used, 0.10 gram is less than one-third the lowest therapeutic dose of 0.32 gram as stated in the U. S. Dispensatory, twenty-first edition, 1926, and only one-twentieth of the maximum therapeutic dose given by the same authority. In all 18 tests have been made, 15 with 0.10 gram of potassium iodide and 3 with 0.10 gram of sodium iodide which was used later in the work because of the less objectionable features of the sodium ion as compared with the potassium ion.

The urine was tested at the end of the first hour in addition to the usual test made at the end of the second hour. This was done by shaking 10 cc. of urine with 0.2 gm. of Norit (a specially prepared decolorizing carbon), and filtering. To 3 cc. of the nearly colorless filtrate is added 1 cc. of starch solution. To avoid the necessity of making fresh starch solutions at frequent intervals, a permanent solution with salicylic acid as preservative is prepared.* 1 gram of salicylic acid is dissolved in 100 cc. of boiling water and 1 gram of starch mixed in. The solution is boiled until the starch paste is completely dissolved, cooled and made up to 1,000 cc.* To liberate the iodine

*Volumetric Analysis: Sutton, 11th Edition, P. Blakiston's Son and Co., Philadelphia, 1924, p. 137.

one-half cc. of concentrated nitric acid is added by drops. If iodide has been excreted in the two hour specimen thus indicating the ingestion of the 100 grams of grape sugar, a deep blue to black color will be noted when the concentrated nitric acid is added. Care must be taken to add the acid slowly and in not too large an amount.

The test can be made with the untreated urine in most cases but when the amount of iodide is very small a much more definite test will be obtained by pretreating the urine with Norit as outlined above.

Summary

A quantitative method for the examination of urine sediments is described which is practical and can be carried through in approximately the same time as the method previously used.

The use of 0.1 gram of sodium or potassium iodide as an indicator for glucose in the grape sugar tests is recommended and data introduced to show that as a test it is reliable and carried out with facility.

Dr. Beckett—I will ask Dr. Charles P. Clark of the Mutual Benefit Life Insurance Company to open the discussion on this paper. Dr. Clark.

Dr. Clark—The further report of Dr. Kingsbury in reference to an improved method for examination of urinary constituents should be of interest to us all. For many years it has been apparent to most of us that the common qualitative tests for chemical analysis have been inadequate, but at the present time simplified methods for quantitative estimation of albumin and sugar are available to those who desire to use them.

The value of these tests in insurance underwriting has, we believe, been proven. Furthermore, within ten or twenty years we should be in a position to state just how seriously the various amounts of albumin affect mortality. We are also working in the right direction in adopting quantitative tests inasmuch as we are using tests which are practically free from personal errors of judgment and errors in technique.

I believe that it is extremely important also to adopt, in so far as possible, technical methods for the estimation of abnormal microscopical constituents in order that the same fallacies above mentioned, may be eliminated. Personally I cannot see the advantage of altering our present procedure in respect to these microscopical analyses, unless our new procedure will give us such reports from the laboratory that we who must pass upon these cases are not left in doubt as to how much significance we must place upon the laboratory findings. It has taken us many years to realize how inadequate qualitative tests can be, and I make the statement not only from the standpoint of one who has done considerable clinical laboratory work, but also because of my experience of eleven years in the underwriting department of one of our insurance companies. After all, we are compelled to look upon our reports from our examiners, together with all other information available, as clinicians, and while it may be easy to select by rule of thumb methods, we are not doing justice either to our applicants or to our company. We expect our examiners to use great care in examination of hearts and the taking of height and weight, in ascertaining measurements and taking blood pressure readings and we are prone to criticize them when, because of slipshod methods, they render us reports that are inaccurate. I think that

it is just that we should do so, for they are employed to protect the company against acceptance of bad risks and if their reports, as submitted to us, are not accurate, if the blood pressure has not been properly taken, and if we have paid an early death claim by reason of that fact, we should not sanction continuance of such an examiner. It was not so many years ago that the blood pressure estimation was first used in Life Insurance work, but thanks to the careful work of Dr. Fisher and his associates, we soon learned what was normal and what was abnormal in our blood pressure determinations. Had it not been for the systematic adoption of this test, we would, no doubt, still be accepting applicants as standard risks who are marked for an early death. We have been employing, as far as possible, standard tests in the field and I feel that we have gone a long step forward in the utilization of one or another of the quantitative tests for albumin or sugar, and I should regret to see that we are satisfied with any microscopical technique unless it is free from errors of technique and errors of judgment.

I have no doubt as to the advantage of Dr. Kingsbury's newer method as compared with the older, and yet I am not certain that it is adequate. The three abnormal constituents about which we are particularly concerned are casts, pus cells and blood cells. I am not satisfied, myself, from the experimental work I have done thus far, that the present methods employed, including the newer technique suggested by Dr. Kingsbury are the best for casts and blood. Personally, I feel that it is not the best for the determination of the quantity of pus present. Notwithstanding Dr. Kingsbury's statement that the estimation of pus cells per volume of urine: e. g. pus cells per cc., is tedious,

the report on going to the desk of the underwriter is based upon accurate determinations and we are better able to decide whether we should or should not consider the amount of pus important. I think that I should also state that the process is not tedious. It is, in my own mind, much less tedious than the process suggested by Dr. Kingsbury. I do not, however, care to discuss further at this time our experiences with this test as it would require more time than is allotted to me.

I agree with Dr. Kingsbury that it is rather an advantage to dilute the sediment slightly before it is placed upon a slide. Very often the sediment is so massed on the slide that one must examine only the periphery in order to observe clearly the various constituents. By diluting the sediment one is able to get a sharp outline of the casts and other materials. Casts are sometimes present in enormous quantities even countable by the same method used for counting pus cells and yet that fact may be overlooked because of the massing of the sediment.

I realize that not only Life Insurance Companies but also clinical laboratories have, for so many years, reported the abnormal microscopical constituents on the basis of number per high powered field that an estimation in terms of number of constituents per unit of volume will not be popularly received. Yet I feel, personally, so strongly impressed with the idea that this is the logical method of determination, that I believe that further experimentation in that direction is justified.

Dr. Beckett—If there is no further discussion on this interesting paper by Dr. Kingsbury, we will proceed with the paper by Dr. Rockwell and Mr. Henderson of the Equitable Life Assurance Society.

EFFECT ON MORTALITY OF A HISTORY OF TUBERCULOSIS

by

THOMAS H. ROCKWELL, M. D.

Medical Director of the Equitable Life Assurance Society

and

ROBERT HENDERSON

Second Vice President and Actuary

From time to time valuable papers have been presented to this Association dealing with tuberculosis and especially its relation to Life Insurance.

Many of the contributions dwelt largely upon the individual's history and present clinical findings, but when prognosis for life insurance purposes was discussed there seemingly has been a marked difference of opinion.

In this connection the results of a recent investigation of the Mortality Experience of the Equitable on policies issued to applicants with a tubercular personal history may possibly be of general interest.

This investigation covered both standard and substandard policies. The standard policies included issues of 1900 to 1923 inclusive, observed up to the policy anniversaries in 1926. The substandard policies included also issues of 1924 and were divided into two classes:

A. History of tuberculosis of lungs.
B. History of other tuberculosis.

The mortality table used for the calculation of the expected deaths in this investigation was the Equitable Select Table based on our standard experiences in the northern United States during the years 1899 to 1909. This may be taken as roughly equivalent to the American Men Select Table.

Table I gives an analysis of the entrants in each of these classes, indicating the average exposure in each class and the percentage distribution of the entrants into groups of ages at entry.

TABLE I.

Analysis of Entrants

Class	Number of Entrants	Average Exposure Years	Percentage Distribution by Ages		
			To 34	35 to 44	45 and over
A	1663*	4.53	45	40	15
B	1264	4.67	68	24	8
	2927	4.59	55	33	12
Standard	3194	6.84	52	31	17

The experience in the substandard classes is by selection units, that is, two or more policies issued at the same time are treated as one policy. The experience on standard policies is by policies except that an adjustment was made to the deaths to eliminate irregularities due to an abnormal number of duplicate policies among the deaths and their irregular distribution among the age groups and durations. This adjustment consisted in substituting, for the actual number of policies terminated by death, the sum of 112½% of the number of deaths and 10% of the excess of the number of policies over the number of deaths. The aggregate effect of this adjustment may be seen from the fact that the total number of policies terminating by death was 171 on 123 lives, the re-

sulting adjusted deaths, upon which the percentages were calculated being 143.

The average exposure of the substandard classes is considerably less than that of the standard policies indicating that the proportion of this type of risk written substandard has been increasing as time goes on. This is due, doubtless, to some extent to the rating up of cases which in the earlier years would have been taken standard or declined outright, but probably it results to a larger extent from the growing familiarity of the agency force with the substandard business which leads to the presentation of cases which in earlier years would not have been solicited.

Table II below gives the actual and expected deaths for each class and the percentage of actual to the expected separated into the experience of the first five policy years and the subsequent experience.

Table III gives the same experience analyzed into three groups of ages at entry, while Table IV gives the combined substandard experience and also, separately, the standard experience, analyzed both by duration and by age at entry. For each class in Table II and for each age group in Table IV is shown the adjusted percentage which is obtained by giving a weight to the experience of the sixth and subsequent years which is four times that given to the first five. This is intended as an approximation to the ultimate average effect of the mortality on the assumption that the experience for each group of durations continues the same as in the past.

TABLE II—By Policy Years

Years	1 to 5			6th and Subsequent			All			Adjusted
Class	Expected	Actual	%	Expected	Actual	%	Expected	Actual	%	Percentage
A	26.2	29	111	25.0	36	144	51.2	65	127	137
B	18.9	33	175	13.8	21	152	32.7	54	165	157
	45.1	62	137	38.8	57	147	83.9	119	142	145
Standard	70.7	68	96	81.8	75	92	152.5	143	94	93
	115.8	130	112	120.6	132	109				
							236.4	262	111	110

TABLE III—By Ages at Entry

Ages	To 34			35 to 44			45 and Over		
Class	Expected	Actual	%	Expected	Actual	%	Expected	Actual	%
A	13.9	19	137	20.7	34	164	16.6	12	72
B	14.7	27	184	10.9	19	174	7.1	8	113
	28.6	46	161	31.6	53	168	23.7	20	84
Standard	48.2	66	137	48.2	37	77	56.1	40	71
	76.8	112	146	79.8	90	113	79.8	60	75

TABLE IV—By Policy Years and Ages at Entry

Years	1 to 5			6th and Subsequent			All			Adjusted
Ages	Expected	Actual	%	Expected	Actual	%	Expected	Actual	%	Percentage
Substandard										
To 34	17.5	26	149	11.1	20	180	28.6	46	161	174
35 to 44	16.1	27	168	15.5	26	168	31.6	53	168	168
45 & over	11.5	9	78	12.2	11	90	23.7	20	84	88
	45.1	62	137	38.8	57	147	83.9	119	142	145
Standard										
To 34	23.6	31	131	24.6	35	142	48.2	66	137	140
35 to 44	21.0	14	67	27.2	23	85	48.2	37	77	81
45 & over	26.1	23	88	30.0	17	57	56.1	40	71	63
	70.7	68	96	81.8	75	92	152.5	143	94	93

It will be noted that of the substandard classes, A presents the more favorable experience. This arises partly from a more favorable result in each separate age group and partly from a larger proportion of entrants at the higher ages. As the general average standard experience of the Society, during a period corresponding to this investigation, ran about 85% of the expected according to the table used, it will be seen that the experience on standard policies showing these impairments averages about 10% above our general standard experience. The excess was, however, entirely in the age group 34 and under, where the crude percentage was 137 and the adjusted percentage 140. It will be noted that, in the substandard experience, the percentage of actual to the expected remains about the same in the age group 35 to 44 at entry, as in the younger age group, whereas, in the standard experience there is a sharp drop in the percentage between these two groups.

Another measure of the relative maturity of the different classes is the percentage of the total expected deaths that are in the sixth and subsequent years. For the two substandard classes combined, this percentage is 46 against 54 for the standard policies, as might be expected from their relative average exposures. When the two substandard classes are taken separately, however, we find that Class A which has a slightly shorter average exposure, 4.53 years against 4.67, has a considerably higher percentage, 49 against 42, of its expected in the longer durations. This arises from the fact that a very high percentage of the entrants in Class B are in the youngest age group. If these percentages are calculated for the various age groups they are as follows:

TABLE V.

Percentages of Total Expected after Fifth Year

Ages at Entry	Substandard	Standard
To 34	39%	51%
35 to 44	49	56
45 and over	51	53
All ages	46	54

In approving such risks for any sort of policy, it is needless to say that we endeavored in every instance to obtain a full and complete past history and to have made a thorough examination. We rarely accepted but one physical examination and frequently in later years have had the benefit of expert X-ray pictures. Then, too, we have paid careful attention to the social, financial and occupational side. Many of us will remember an aphorism of the late Francis Delafield, for many years professor of medicine in the College of Physicians and Surgeons, in which he said: "The treatment of tuberculosis is largely one of dollars and cents."

Dr. W. W. Beckett in 1922 sagely remarked: "I would rather be treated in a poor climate in a first-class sanatorium, than in a good climate outside of a sanatorium." We, too, believe that patients who have been treated in a good sanatorium will do better on the average than those who have not both because they have received better treatment, and also have had practical instructions as how to care for themselves when the disease has been pronounced arrested.

In our table of ratings for tuberculosis we have in-

dicated a numerical rating between two and five years; as a matter of fact we have taken very few who have shown any active symptoms within five years. It is very difficult to determine just when a case is arrested. Those who have had careful sanatorium treatment are in a position to furnish us with data which may be of use in this connection.

Dr. E. S. MacSweeney, in a valuable paper presented to this Association in 1925, remarked: "Up to the fifth year, consumptives are a foolhardy risk; from the fifth to the tenth, much less hazardous, and after the tenth pretty fair." We believe he is pretty nearly right, and our numerical ratings covering the five year period, except in very favorable instances, are almost prohibitive.

At the meeting of 1921, we reported to you the ratings the Equitable was using at that time but we have subsequently modified them. The following is our present practice. Please understand that these ratings, in so far as they vary, according to the build of the applicant, are based on the Equitable Build Tables, with which most of you are familiar. They are to be added to the basic build ratings which for young lightweights are already considerably in excess of 100.

A. Arrested Tuberculosis. Without any physical signs.

	Age	—25%	—20%	—15%	—10%	—5%	0	+5%	+10%	+15%	+20%	+25%
Within 2 yrs. all ages		D	D	D	D	D	D	D	D	D	D	D
	25	D	+215	+180	+145	+120	+100	+85	+65	+65	+60	+55
	30	+205	+180	+160	+135	+115	+95	+80	+65	+60	+50	+40
	35	+170	+150	+135	+125	+105	+85	+75	+60	+50	+40	+30
2 to 5 yrs.	40	+140	+125	+115	+100	+85	+70	+60	+50	+40	+30	+20
	45	+120	+100	+85	+70	+60	+50	+45	+35	+30	+20	+15
	50	+100	+80	+70	+55	+50	+40	+35	+30	+25	+15	+10
	55	+65	+55	+45	+40	+35	+25	+25	+20	+15	+10	+ 5
	25	+160	+140	+120	+95	+80	+65	+55	+45	+45	+40	+35
	30	+155	+130	+110	+90	+75	+65	+55	+45	+40	+35	+30
	35	+145	+120	+100	+80	+70	+60	+50	+40	+35	+30	+25
5 to 10 yrs	40	+110	+95	+80	+65	+55	+45	+40	+30	+25	+20	+15
	45	+80	+65	+55	+45	+40	+35	+30	+20	+20	+15	+10
	50	+60	+50	+45	+40	+35	+30	+25	+15	+15	+10	+ 5
	55	+40	+35	+30	+25	+25	+20	+15	+10	+10	+ 5	0

B. Arrested Tuberculosis. With physical signs.

Within 2 yrs., all ages		D	D	D	D	D	D	D	D	D	D	D
	25	D	D	D	+210	+175	+145	+120	+95	+90	+80	+70
	30	D	D	D	+195	+165	+135	+115	+90	+80	+70	+65
	35	D	D	D	+185	+155	+125	+105	+80	+75	+65	+45
2 to 5 yrs.	40	D	+205	+175	+145	+120	+95	+75	+60	+55	+45	+30
	45	+200	+145	+125	+100	+85	+70	+55	+45	+35	+30	+20
	50	+150	+110	+90	+75	+65	+55	+45	+35	+25	+20	+15
	55	+125	+75	+65	+55	+45	+40	+30	+25	+20	+15	+10

	25	D	+200	+170	+140	+120	+95	+80	+65	+60	+55	+45
	30	D	+185	+155	+130	+110	+90	+75	+65	+55	+45	+35
	35	+190	+165	+145	+120	+100	+80	+70	+60	+50	+40	+25
5 to 10 yrs.	40	+155	+130	+115	+95	+80	+65	+55	+50	+40	+30	+20
	45	+105	+95	+80	+65	+55	+45	+40	+35	+30	+20	+15
	50	+85	+75	+65	+50	+45	+35	+35	+30	+20	+15	+10
	55	+65	+50	+45	+35	+30	+25	+25	+20	+15	+10	+10

C. Arrested Tuberculosis.

	25	+75	+65	+55	+45	+40	+30	+30	+25	+25	+20	+15
	30	+70	+60	+55	+45	+35	+30	+30	+25	+25	+20	+15
	35	+60	+55	+50	+40	+35	+25	+25	+20	+20	+15	+10
After 10 yrs.	40	+50	+45	+40	+30	+25	+20	+20	+15	+15	+10	+10
	45	+35	+30	+25	+20	+20	+15	+15	+10	+10	+ 5	+ 5
	50	+30	+25	+20	+15	+15	+10	+10	+ 5	+ 5	0	0
	55	+20	+15	+10	+10	+10	+ 5	+ 5	+ 5	+ 5	0	0

As a sidelight to the above, the following may be of interest:

From Sub-standard Experience 1900 to 1926.

	All Deaths	Deaths due to Tuberculosis	Mortality Ratios	Normally the deaths from Tuberc. would be
20% Lightweight	32	8	112%	2
Personal Condition 181—841—842	80	23	110	5
20 to 39% Overweight	521	6	134	43
40 to 59% Overweight	255	1	149	23
60% Overweight	17	-	164	2

Of the deaths among those insured in the Standard class, 13% (16 out of 123) of the actual deaths, or approximately 12.2% of the expected deaths were from tuberculosis. In Class A, the deaths from this cause were 40% (26 out of 65) of the actual, or 50.8% of the expected and in Class B, they were 24% (13 out of 54) of the actual or 39.8% of the expected. The corresponding percentages for the company's entire standard experience are 8.6% of the actual, or 7.3% of the expected.

From 1912 to June 30, 1927, we have had 1,770 claims for tuberculosis in our Disability Class. Of these 450 are dead; 622 recovered, and 690 still in force. Of those who died, the average length of disability was 18 months. Those terminating in recovery averaged 21 months.

It is but reasonable to expect a future improvement in cases of tuberculosis generally, and this should favorably affect our mortality.

Dr. Beckett—Dr. Rockwell, do you care to say anything?

Dr. Rockwell—I suppose the proper way to begin the discussion of this is to make an apology, but the only apology the writers of this short paper have to make is that we discovered some 6,000 people who had had tuberculosis of one form or another had received policies in the Equitable, and we wanted to determine whether we were right or whether we were wrong in extending the benefits of insurance to these people, of whom there are so many in this world and in this country, and whether there is a rate under which we may accept some of them. Hence a study

was made, embracing about 3,000 standard lives and about 3,000 substandard lives.

In our standard class we came out fairly well, being measured by the Equitable Select Table, which is comparable to the American Men's Select Table, and we found we got by pretty well with the standard class, having a mortality of about 93. In the substandard class we divided them into two groups, history of tuberculosis of the lungs, and other tuberculosis, and these two gave us a combined mortality of about 145. We have appended in this the table we are using at the present time for rating these cases, combined and used with the build table which our actuary has presented to this Society before, so that in selecting these lives, we are using that build table and the ratings which are already recorded.

Several years ago we modified this table a little bit and the question of course, arises whether at the present time it is wise to go further in modification or stiffen it up. For that reason, I think a discussion would certainly be valuable to us, and with that, Mr. Chairman, I suggest that Dr. Rogers, if he is willing, introduce the Second Vice President and Actuary of the Equitable and then proceed with the discussion of the paper.

Dr. Beckett—Dr. Rogers, we would be glad if you will present Mr. Henderson to the Association.

Dr. Rogers—It will give me great pleasure to do that—after I have had a little fling myself at the subject.

I think this is an extremely valuable contribution. It opens up a field which has not been altogether covered by the papers which Mr. Hunter and I have presented in the past on the subject. When we first

began to do a substandard business, the subject of build had not yet been reduced to a scientific basis and we in the New York Life constructed a table of mortalities for build based on the average weight at each age.

Several years later the Equitable constructed a table of mortalities based not on the average weight at each age but upon the best weight, which for all adult ages happens to be the average weight at about age 37. I am inclined to think that, if we had not already organized our machinery and been doing business for a number of years on the average weight table, we would have adopted the best weight table in its stead, but the change from one method to the other would have involved a reconstruction of our entire organization and a retraining of our lay staff. This best weight table I believe we owe to Mr. Henderson and the table of ratings which he and Dr. Rockwell have placed before us represents the additions to be made to the best weight table for various forms of tuberculosis, and should be of very great value to all of us, and especially to those companies who have followed the best weight standard rather than the average weight standard.

I may say also that I have been a good deal struck in looking over the table with the probable composition of the mortality groups that constituted the standard class of the Equitable. Notice that if the tuberculosis without physical signs had occurred between the second and fifth year, a person must have been 25 per cent over the best weight at age 40, ranging to 10 per cent overweight at age 55. In other words, that selected group in which the mortality of the Equitable has been so fine has been very, very carefully selected so far as the

matter of build is concerned, so that in studying the mortalities that are presented in this table, it means that we must have in mind with regard to the standard class that that class is composed of persons who are very decidedly overweight; moreover, the mortalities that the Equitable has experienced in the substandard class are such as to suggest that the additions to the rating called for by their standard has operated to select that group with a good deal of care.

I have only a feeling of the greatest satisfaction in seeing work of this sort done. I think the principal devil in the play of producing a table of standards built on best weights is Mr. Henderson of the Equitable, whom you did yourselves and him the honor yesterday to elect as an honorary member of this Association. My feeling is that honorary membership in the Medical Directors Association should be limited to persons who have by distinguished service been given a right to that distinction, and if I were to cast about for any one person in that awful group of acturaries who has placed this Association under obligations to him, I should be inclined to think that Mr. Henderson is that person. I don't know whether you will be able to understand Mr. Henderson's language. These actuaries are all Scotch and judging from his name and his characteristics, I should say that he is a Scotchman of the Scotch.

It gives me great pleasure to present Mr. Henderson to the Association.

Dr. Beckett—Gentlemen, Mr. Henderson of the Equitable.

Mr. Henderson—I suppose I should feel perfectly safe, Mr. President and gentlemen, among so many

doctors, but I am afraid my blood pressure is a little above normal just at the present time. It goes without saying that it is extremely gratifying to me to have been honored in the way you have been so kind as to do in electing me an honorary member of this Association. Some of the most satisfactory associations in my work have been with our friends, Dr. Rogers, Dr. Willard, Dr. Toulmin and our late friend, Dr. Symonds and others with whom I worked on the Joint Mortality Committee.

Perhaps I may be permitted a few words on the build table to which Dr. Rogers referred. Dr. Rogers referred to it as a build table based on the best weight. That is as it turned out in our anaylsis of the experience after we had applied all the adjustments and determined our ratings. It may or may not continue to be the best weight and other people may have different ideas as to whether the best weight is constant for all ages, but our idea in adopting a constant weight for all ages as the basis of our build table was to simplify the work, because it was capable of mathematical demonstration that a build table could be based on that which was for all practical purposes the same as the one built on the average weight for each age.

I thank you very much, gentlemen, for your attention.

Dr. Rogers—Mr. President, may I intrude here for just one moment? At the last meeting of the Actuarial Society, the subject of occupation was presented and discussed at some length, and I have just learned this fact that the Actuarial Society has authorized the representatives of the Actuarial Society on the Joint Committee to make an intensive study

of occupations with a view to bringing our information on that important subject down to date. I think it would be very proper if you gentlemen would pass a similar resolution authorizing on behalf of the Medical Directors' Association the members of your Association who are members of the Joint Committee, to take up with the actuaries that work, and, Mr. President, I so move.

Dr. Rockwell seconded the motion and it was carried.

Dr. Beckett—I shall ask Dr. Scadding to continue the discussion of the paper by Dr. Rockwell and Mr. Henderson.

Dr. Scadding—The longer one is occupied as an insurance medical advisor, the more one is interested in, and satisfied with, just such contributions as Dr. Rockwell and Mr. Henderson have made on this occasion. For the more speculative work in which many of us may be engaged, too long a time must elapse before one can get the answers to our self-imposed riddles, and, in the nature of things, many of us must pass on without the gratification of solution. For the younger members of the Society, much scientific interest in results, similar to those now laid before us, is in store. The members of this Society, as in the past, will, I am sure, continue to exert a very steadying influence in the various medical academies of the country. They have, in some degree, and will have in large measure in the future, the foundation of cold facts on which alone reasonably accurate forecasts can be reared, and will be able, as they have been in the past, to offset the fantastic prognoses that some of our specialists may be inclined to indulge in.

The surprises of the experience are the very slight

increase over the average mortality, at all ages, in the cases taken as "standard," and the heavier mortality in Class B as compared with Class A of the "Sub-standards." In discussing this paper with one of my sanatorium friends, he was inclined to believe that the favorable experience of "A" is partly explained by the intensive anti-tuberculosis campaign of the past quarter century. The training of sanatoria and the many good results of treatment obtained therein have increased the longevity of that group of patients which might come up for insurance.

It is evident that there have been enough patients treated in this generation to have materially raised the duration of life following onset of disease in the tuberculous community at large. Naturally the longevity of ex-sanatorium patients will depend upon the standards obtaining in such institutions regarding admission. The Adirondack Cottage Sanatorium, now known as the Trudeau Sanatorium, the oldest on the continent and one with the longest and best maintained records, has always observed considerable restriction in regard to patients admitted; and their figures would be, undoubtedly, relatively high. In the forty-second year of this sanatorium, 38% of patients discharged, who had been discharged at least ten years, are now living; 33% being well; and 5% living but not well—making 38% in all living. The group of the cases on admission were minimal 28%, moderately advanced 63%, and far advanced 9%; so that, compared with the general population of the tuberculous, the far advanced were relatively few. I daresay that a third of such a group might be expected to live fifteen to twenty years, or even to exceed the latter figure. It has been estimated that the average of

many sanatorium groups is upwards of ten years, while seven years would appear to be the life of the average tuberculous in the community.

R. M. Picken, a Scots authority (Lancet, 1919, Volume 2, page 106), found that the average expectation of life of all males of the age of thirty, suffering from pulmonary tuberculosis, was 3 1/2 years; of those notified at an early stage, with hope of recovery, 6 1/2 years; and of arrested sanatorium dischargees, about fourteen years. As a normal expectation of life for the age of thirty is in excess of thirty years, he contends that the expectation of life of patients, who have secured the best obtainable result of treatment, is less than one-half the normal.

In the cases taken as standard, there was evidently a very close selection. Is it not probable that a few of these cases diagnosed as tuberculous were actually not so? Close selection can produce wonderful results; witness the effect of this in the cases giving a family history of tuberculosis, selected by our predecessors a generation or so ago.

It is of interest to note that the substandard experience has a lower average exposure than the standard business, for which I believe there are two reasons; first, and of less importance, because the issues of 1924 are included in the substandard experience, whereas the standard policies are issues of 1900-1923 only; second, and of more importance, cases which were accepted substandard as time went on, would probably have been rejected altogether in the earlier years of issue, that is, substandard business probably did not commence to any extent until the later years of issue in the experience. The authors believe that there is another factor, namely, the growing familiar-

ity of the agency force with substandard business, resulting in applications which in earlier years would not have been solicited. Is it not likely also that as the numbers of arrested and cured cases multiplied, there had been a proportion of these, who, even at the risk of being strongly suspected of selection against the company, had come to buy insurance "at the counter," not having been solicited? Admittedly rare occurrences nowadays.

For the purposes of this paper, I have no doubt, it was best to have only the two divisions of the cases taken as "substandard," but a further subdivision of "B," showing how many were affections of the bony framework, how many cervical glands, how many tuberculosis of the peritoneum, testes, etc., would be very interesting. Perhaps Dr. Rockwell could give us a general idea as to what was the relative frequency, in the Equitable's collection of cases, of tuberculosis in locations other than the lung.

While Class A, Table III, shows the heavy mortality in the age group to 35, it shows a relative increase in the 35 to 44 period over the period to 35, which is rather in accord with the curve shown by older communities such as England, in which the maximum is said to be from 45 to 55, especially in men. It is noteworthy that as a community becomes industrialized, the mortality rises in the later decades and shows a proportionate fall in the early decades. The higher mortalities in the third and four decades are rather suggestive of tuberculosis in a community becoming industrialized.

That the actual number of "B" entrants was smaller than Class A, was probably due to the fact that the proportion of nonpulmonary forms of tuber-

culosis is materially less than the pulmonary. In casting about for some explanation for the relatively heavier mortality in Section B of the substandards, it occurred to me that possibly, at least in the age group to thirty-four, there was, in addition to the tubercular manifestations in bone or gland or what not, an undiscovered focus in the lung. Foci may well be existent in the lungs, not demonstrable by minor methods of examination and not necessarily demonstrable even by X-ray as parenchymatous lesions, but rather glandular lesions. While this is possible, I believe the more reasonable explanation, suggested by the authority above referred to, is that the relatively bad results in this class are due to the fact that the nonpulmonary forms of tuberculosis bespeak a blood infection with development of tuberculosis at some point of minor resistance, increased local resistance at other points being able to keep down, at any rate for a period, other deposits; and the fact that there was, or is, a blood infection, therefore means that there may be other foci develop later. Surgical forms of tuberculosis, when bad, are very bad, and arrest is probably more difficult with them in adults than the pulmonary forms. I suppose we have, as examiners and advisers, had less fear of the nonpulmonary forms of tuberculosis, believing many of them to be due to the bovine types of bacilli, which man can take care of better than of bacilli from human sources. It is probable, too, that the histories in Class B relate to the diagnosis of a tuberculosis at a date considerably prior to the issue of the policy, as compared with the histories of pulmonary tuberculosis in relationship to the issue of policies.

I think we will all agree that it is very difficult to

determine just when a case is arrested. The scheme for classification adopted by the American Sanatorium Association, I think in 1921, defines arrested as, "All constitutional symptoms and expectoration with bacilli absent for a period of six months, the physical signs to be those of a healed lesion, roentgen findings to be compatible with the physical signs." The Committee of the Association defines "Apparently cured" as "All constitutional symptoms and expectoration with bacilli absent for a period of two years under ordinary conditions of life"; and it defines "ordinary conditions of life" as implying that "the patient is able to live in an environment where he is able to support himself without the assistance of others, or to live in his former surroundings and pursue his former occupation." It occurs to me that the word "arrested" is a fair one for our common use, but I have no doubt that the sanatorium authorities would tell us that the cases we are willing to accept would be more properly classified as "apparently cured."

In selecting the pulmonary group, the two great factors in favorable prognosis are undoubtedly the disappearance of bacilli and their continued absence from the sputum for a considerable time, and the ability to gain weight under conditions of reasonable exercise.

I suppose that no pulmonary case involving more than a very moderate amount should be considered nowadays without a complete roentgenological study of the chest. Certainly no such case should be taken without that aid within a two-year period, preferably not until five years have elapsed. The importance of the X-ray in illuminating the pathological condition and showing the historical evidence cannot be over

estimated. Since the X-ray findings were practically valueless prior to 1915, the Equitable might be congratulated upon securing such favorable results without the assistance of the X-ray in many cases. Perhaps Dr. Rockwell would tell us whether his company had set any definite limits of risk for their cases taken as standard and substandard, or if that is left to the discretion of their insurance committee, having regard to "the social, financial, and occupational side" as well as the medical picture.

The "sidelight" table emphasizes the importance of overweight so far as tuberculosis is concerned, but it would appear that in avoiding the Scylla of underweight there may be some danger of running on the Charybdis of obesity.

Under Class A the deaths from tuberculosis were 40% of the total deaths, while under Class B they were 24%. This is interesting in view of the figures in Table No. 2, showing the adjusted percentages of actual to expected in Class A as 137, and in Class B as 157. This perhaps indicates that we should modify our ideas that a fair number of the non-pulmonary forms were of bovine type, or modify our opinion as to the ultimate seriousness of such infection. If a pulmonary case ends in a terminal pneumonia, the death certificate in most cases is returned as "Tuberculosis"; but in the non-phthisical cases the primary cause is very often lost sight of entirely, and the cause of death is returned as some such effection as uraemia, septicaemia, amyloid, kidney or liver, etc.

A comparison of the Equitable's rating table with that of the rating manual of the Canadian companies shows the latter to be rather more lenient at the

earlier stages and less so at the older. We have made a closer subdivision of the age groups (2 to 3 years, 3 to 4, 4 to 5 rather than from 2 to 5 years). I hope that the result of our selection of the cases will be as satisfactory as the Equitable's has been. Pretty general use of liens with us, rather than the ratings for such cases, may offset the difference as between the Equitable's table and ours. The Equitable may have some note referring to the use of their rating table for their own guidance, and I suppose there is some direction as to what physical signs are permitted under heading "B" of their schedule. In order to conform with A. S. A.'s classification, might one suggest that the words "of a healed lesion" follow upon the words "with physical signs" in the heading?

The authority, referred to earlier in this discussion, was very much interested in the Equitable Rating Table, and declared that, after twenty-seven years of tuberculosis and having attained the age of fifty-five, he felt encouraged to apply for insurance.

From 1911 to June 30th, 1927, the Canada Life has had 69 claims for pulmonary tuberculosis in our disability class. Of these, 18 are dead, 21 have recovered, and 30 are still in force. Of those who died, the average length of disability was 22 months. Those terminating in recovery averaged 2.6 months. If the above claims are raised to 1770, as in the paper, the dead are identically the same, 450; the recovered 525, as compared with 622; and the still in force 750, as compared with 690 in the paper.

It is of interest to compare the average length of disability for those who died, as it is quoted near the conclusion of the paper, with the average length for all causes in the report of the Committee on Disability

Experience presented to the Actuarial Society in 1926. In that experience (being the experience of twenty-nine companies), where waiver of premium only was the benefit, the period from disability to death was approximately eighteen months, and for the benefit with ninety-day clause and with monthly income, it was eight months. In the present paper the average length of disability from tuberculosis is given as 18 months and we accordingly conclude that the average length of disability from tuberculosis is greater than that from all other causes of disability combined. Would the authors be good enough to tell us what was the average period of disability in their company for all causes of disability combined?

I fear it will take a lot of courage to "tack on" the total disability feature to contracts of the kind referred to in this paper, but we do so many things today at which we would have held up our hands in holy horror yesterday, that we may yet be willing, at considerable odds, to take some chances on this feature, at least in the cases taken as standard.

The authors look forward to a future improvement in cases of tuberculosis generally. They have the remarkable statistics, published by the Trudeau and other sanatoria of the after histories of their patients, on which to base that optimistic view. When one considers the remarkable reduction in the mortality from tuberculosis in the last generation, he is lost in admiration of that galaxy of specialists, many of them victims of the disease, to whose indefatigable efforts in sanatoria or in private or public service the brilliant achievement is due. The "lives that stand out in headlines and are beacons to all mankind" in Canada generally get government recogni-

tion, but this university of men, by whom the successful warfare against tuberculosis has been waged, have in the main received comparatively little encouragement from, and been meagerly supplied with the sinews of war by governments or an indifferent public. Yet their good work goes on, perhaps not spectacularly, but steadily and surely.

By accepting these cases by way of an experiment, insurance companies may be credited with some very practical courage and with sympathy towards the crusade against tuberculosis. Now that it is shown by such an experience that, with reasonable care and not excessive loading we can do this business, if not very profitably certainly without great loss, is it not possible for some of our great institutions to go further and provide some financial aid to sister institutions engaged in the greatest battle of all time against disease? I understand a recent ruling in Canada opens the way.

Dr. Beckett—Will Dr. Weisse of the Mutual Life continue the discussion?

Dr. Weisse—I have no real discussion to make of Dr. Rockwell's and Mr. Henderson's paper, because I feel about that as I did yesterday, about Dr. Rogers' paper. It is not a case to discuss so far as I can see, so the only thing I can do is to present our experience along the same lines. While it is very much smaller, it is distinctly corroborative.

The experience of the Mutual Life Insurance Company has been neither as large nor as lengthy as the standard experience of the Equitable Life Assurance Society, as reported in Mr. Henderson's and Dr. Rockwell's very interesting paper. Our group represents 330 entrants, with 7 deaths, exposed 18 years,

while the standard group of the Equitable represents 3,194 entrants and 143 deaths, exposed 26 years.

As we do not accept any risks on other than standard basis, we have no remarks to offer with reference to the substandard experience.

Our material is represented by 330 entrants, definitely tubercular, arrested or cured.

The study of these entrants (Group A) is based on policies and amounts of insurance, accepted by The Mutual Life Insurance Company of New York on standard rates during the 18 years from 1907 to 1924 inclusive—period of observation carried to policy anniversaries of 1925.

Two standard tables have been used to obtain the ratio of actual to expected, namely (1) The Medico-Actuarial Select Table (M. A.), and (2) The American Men Select Table (A. M.).

We have practically no experience in Group A prior to 1907. During the first 10 of the 18 years which our experience covers, comparatively few cases were taken in this group, the great bulk of them having been insured since 1917-18.

The cases accepted in this group since that time have practically all been over 30 years of age, not over 10% below standard weight, family record free from tuberculosis and a period of 10 years having elapsed without symptoms. The great majority of them showed no signs on physical examination, or, at the most, a very limited fibrosis at one apex. We have not, so far as I know, taken any cases with evidence of bilateral involvement. Many of these cases had X-ray study, and, of course, we have gone very carefully into the personal history in every case.

Group A—Arrested or Cured Pulmonary Tuberculosis

Issues of 1907 to 1924, Exposed to 1925

Ratio of Actual to Expected by the M. A. and A. M. Tables

Summary by Ages at Entry—Policy Years One to Five

Ages at Entry	Entrants		Exposures		Terminated by Death		Ratio of Actual to Expected			
							M. A.		A. M.	
	No.	Amount	No.	Amount	No.	Amount	No.	Amt.	No.	Amt.
Under 40	123	$ 741,000	385	$2,510,500	–	–	–	–	–	–
40 & Over	207	1,240,800	633	3,587,200	2	$10,000	32.8	30.8	36.0	33.9
Total	330	1,981,800	1,018	6,097,700	2	10,000	25.3	22.4	27.9	24.9
Policy Years Six & Over										
Under 40			98	496,000	–	–	–	–	–	–
40 & Over			131	485,700	5	21,000	213.7	269.5	198.4	244.9
Total			229	981,700	5	21,000	167.2	190.4	156.3	176.3
All Policy Years Combined										
Under 40			483	3,006,500	–	–	–	–	–	–
40 & Over			764	4,072,900	7	31,000	83.0	76.9	86.6	81.5
Total			1,247	7,079,400	7	31,000	64.3	55.6	67.6	59.5

Owing to the very rigid selection practiced among cases with a history of pulmonary tuberculosis, including the 10-year period of postponement after complete recovery, the mortality ratio in Group A by the A. M. Select Table was 27.9% by policies and 24.9% by amounts during the first five policy years. In policy years six and over, the mortality was excessive, being 156.3% by policies and 176.3% by amounts. In all policy years combined the ratios 67.6% by policies and 59.5% by amounts, are substantially lower than the general experience of the same period covered by this investigation, which were 81% and 84% respectively by policies and amounts by the same table.

Of the 7 deaths in this group, 2 died in the 4th policy year from heart disease; 2 in the 8th policy year from lobar pneumonia; 1 in the 9th policy year from cerebral hemorrhage; 1 in the 10th year from tuberculosis and 1 in the 11th policy year from lobar pneumonia. The 1 death from tuberculosis represented 14.3% of the total deaths in this group, as against 7.5% in the general experience of the Company from the same cause. Four of the 7 deaths fell in Build Group 6 and the remaining 3 were in Build Group O.

We have another group (B) made up of 854 entrants, who have given a history of blood spitting or haemoptysis or of suspected tuberculosis of the lungs, or of M. I. B. records 110 and 110s, but without physical signs or obtainable definite history of pulmonary tuberculosis. The issues and period of exposure were the same as in Group A.

The general custom of our Company for a number of years has been not to accept a definite history of blood spitting or haemoptysis until 10 years have elapsed with the applicant still in good health. Many in this group of cases were accepted at ages younger than those in Group A, but with the same restrictions with reference to tubercular family history and weight.

Group B—Suspected of Having Had Pulmonary Tuberculosis

Issues of 1907 to 1924, Exposed to 1925

Summary by Ages at Entry—Policy Years One to Five

Ages at Entry	Entrants		Exposures		Terminated by Death		Ratio of Actual to Expected			
							M. A.		A. M.	
	No.	Amount	No.	Amount	No.	Amount	No.	Amt.	No.	Amt.
Under 40	499	2,581,900	1,599	8,071,900	5	43,000	67.1	113.7	78.0	131.5
40 & Over	355	1,923,600	1,059	5,201,100	4	16,000	42.9	33.5	47.2	37.4
Total	854	4,505,500	2,658	13,273,000	9	59,000	53.7	69.0	60.5	78.1
Policy Years Six & Over										
Under 40			306	1,063,000	2	2,500	115.6	40.7	117.6	40.8
40 & Over			105	374,000	1	1,000	77.5	22.2	69.4	20.3
Total			411	1,437,000	3	3,500	99.3	32.9	95.5	31.7
All Policy Years Combined										
Under 40			1,905	9,134,900	7	45,500	76.3	103.5	86.3	117.2
40 & Over			1,164	5,575,100	5	17,000	47.1	32.6	50.5	35.6
Total			3,069	14,710,000	12	62,500	60.6	65.0	66.6	72.2

The results in Group B—suspected pulmonary tuberculosis—are in accordance with the expectation that the mortality might be higher at the younger ages under 40 both in the first five policy years and in policy years six and over. It will be noticed that the mortality ratio by policies for all ages and all policy years is about the same as in Group A.

Of the 12 deaths in Group B, there were 3 deaths in the first year, 1 from epidemic influenza, 1 sudden death and 1 ill defined death. In the second policy year there were 3 deaths, 1 from epidemic influenza, 1 from apoplexy and 1 by suicide. In the third year there was 1 death by suicide. In the fourth year there were 3 deaths, 2 from chronic nephritis and 1 from acute peritonitis. In the sixth year there were 2 deaths, 1 from epidemic influenza and 1 from apoplexy. In the twelfth year there was 1 death from tuberculosis, 8.3% of the total deaths in this group. Seven of the 12 deaths were in Build Group 6, one in Build Group O and four in Build Group 1.

Our amount of material is small and our exposure, while covering a comparatively long period, is short for the individual case. As far as we have gone our experience has been satisfactory, although our one death from tuberculosis in Group A was almost double the general experience of the Company with regard to tuberculosis.

I agree with the authors of the paper that we have every reason to expect a continued improvement in the case of tuberculosis, with, I trust, a corresponding improvement in our mortality.

I hope that after an additional eight years' exposure, we may have as favorable a mortality as that shown by Mr. Henderson and Dr. Rockwell.

Dr. Beckett—Dr. Rockwell, will you close the discussion?

Dr. Rockwell—It is very interesting to note that Dr. Scadding, in speaking of the cures said the duration of pulmonary tuberculosis was about seven years. After the article was written, we put in something about the Equitable's experience in the disability class, not that it had any bearing on this at all but just to pad it a little bit, but it is also very interesting to note that Dr. Scadding's experience multiplies into almost exactly our experience with the number of deaths that we have had. In our disability class, out of 1,770 claims, 622 recovered (so they do get well), and 662 are still in force. The duration of the disability was 18 months for those who died and 21 months for those who recovered, which is a considerable difference between that and seven years.

Now, in reference to those two classes; Class B is other tuberculosis. It is a miscellaneous class, but composed—while I have no figures—mostly of tuberculosis of bone and glands. Of course, the others are comparatively small. Whether it would pay to divide it, Mr. Henderson can tell you better than I whether it would pay to split that class at the present time and make a real study of it. How do you feel about that, Mr. Henderson?

Mr. Henderson—Why, the mere fact that our total actual deaths in Class B is 54, if we tried to split that into classes where possibly only one or two of them would make 10 per cent of the total, you wouldn't get enough deaths on which to base a percentage.

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Dr. Rockwell—Dr. Scadding asked if we gave at-

tention to other factors than the fact of tubercular history, environment, finances, location, occupation, etc. We certainly do, because we feel, as I have remarked in the paper, that persons who are in a good environment, socially and financially, do better than those who are not able to avail themselves of treatment in well-regulated sanatoriums, as you, Dr. Beckett, brought out last year. We feel more lenient toward them, but when you think in the 20 odd years that we have been making this study we had 6,000 cases, that's all. Think how many people were presented to us in that time who gave a history of tuberculosis.

In reference to all causes of disability combined, I know of no figures, do you Mr. Henderson? Dr. Scadding asked if we had any records of combined causes of disability.

Mr. Henderson—We haven't any more. We might look into it.

Dr. Rockwell—I want to thank both Dr. Scadding and Dr. Weisse for discussing this paper and I think it is a move in the right direction, perhaps, to make us all feel a little more sympathetic to the better sort of tubercular cases.

Afternoon Session.

Dr. Beckett—The meeting will please come to order. First I want to introduce my successor, your next president, Dr. Daley.

I am sure the Society has made no mistake in electing Dr. Daley for their next president, and I bespeak for him the very warm and cordial and responsive treatment that you have given to the present presi-

dent. I will take pleasure in turning over the gavel to him after we have listened to the next two papers, and I want at this time to thank those who have assisted me so much in making this meeting the measure of success that it has been.

Our next paper will be by Dr. Folin of the Metropolitan Life Insurance Company, "Some New Observations on the Distribution of Sugar Within the Animal Body."

SOME NEW OBSERVATIONS ON THE DISTRIBUTION OF SUGAR WITHIN THE ANIMAL BODY

by

DR. OTTO FOLIN

Metropolitan Life Insurance Company

When a normal person is given a test meal of 100 grams of glucose one obtains the following results: Within a few minutes there is a variable but unmistakable rise in the level of the blood sugar. Accompanying this rise in the level of the circulating sugar there may or may not occur an increase in the sugar eliminated with the urine. But at all events the sugar excretion is limited to extremely small quantities and this slight excretion is now commonly called glycuresis, a term introduced by Benedict to designate normal sugar excretion from abnormal glycosurias. Within three to four hours after such a test meal all the sugar has been absorbed from the digestive tract and the blood sugar is again at a normal or even subnormal level. At the end of this time the sugar, insofar as it has not been used up, is deposited in the form of glycogen. All this is recognized by the simple matter of fact information as to the disposal of carbohydrate within the body.

But when one tries to study the disposal of the sugar in its finer details one encounters a great many difficulties. For example, if one injects a given amount of glucose into a dog and tries at once, within a few minutes, to discover just how that sugar is distributed one cannot show where it is. Within 10 minutes after such a sugar injection all but 15 to 30 per cent

has already left the blood and it has been extremely difficult to locate more than a very small fraction of the sugar which has escaped from the circulation. The total amount of sugar which can thus seemingly disappear within an animal has been so large that many seem to believe that the sugar must be converted into some unknown material, as, for example, some kind of fat. It certainly has not been converted into glycogen in such a short time because if it were in the form of glycogen it could be found and accounted for.

This problem of what becomes of circulating sugar has lately become more important, because until one understands the processes involved one can scarcely get a satisfactory explanation of how insulin brings about such pronounced effects on the levels of the circulating blood sugar.

During the past three years, we have been studying this problem of distribution, and I believe that we are now able to state what happens. Some of our findings may be of general medical interest.

The starting point for our research was the conviction that there must be something wrong with the idea that it is not possible to recover by analysis sugar actually injected into an animal. After dozens of dogs had been analyzed following sugar injections, we were forced to admit, however, that we certainly had not got back the sugar which must be in the dogs in one form or another. The outstanding fact from this period was that the one place, the muscles, where we expected to find the most, we found the least of the injected carbohydrate. Skeletal muscles are always very low in sugar. Ten minutes after the injection of 3 gms. per kilo of body weight when the

blood sugar is still at a level of 600 to 700 mg. per cent one never obtains more than 150 mg. per cent of the muscles, usually much less, and most of this is not really sugar.

Under normal conditions there is almost no free sugar at all in muscles; and in the course of half an hour or less after a sugar injection there is no glycogen formation worth speaking of either in the liver or in the muscles. It is not, of course, a simple matter to first take samples of blood and tissues from a dog, then to inject sugar, and again take samples of blood and tissues, and expect to piece together the numerous analytical figures obtained for sugar and glycogen so as to account for the injected glucose.

However, we finally solved the problem, at least to our satisfaction, and in a comparatively simple manner. Instead of working with dogs and trying to show just where the sugar went, we began to work with smaller animals (guinea pigs), which could be hashed up into one uniform paste, the analysis of which was a comparatively simple matter. By the analysis of such guinea pig pastes of animals which had received no sugar and of those which had received known amounts we soon found that all or substantially all that had been injected could be recovered. The animals were killed, by a blow on the head, 30 minutes after the sugar injection, and at the end of that time we found that the glucose was still present as free sugar and not in the form of glycogen. Other carbohydrates, as, for example, cane sugar, can be completely accounted for when similarly injected into guinea pigs.

Experiments of this sort showed conclusively that there is no mysterious or unknown transformation of

injected sugar into material which cannot be determined by suitable sugar methods.

After we had satisfied ourselves of the correctness of this fundamental concept we returned to the problem of trying to show just where the sugar goes, just how it is distributed, in larger animals. The sugar obviously must be unequally distributed; since muscles take up very little, other tissues must receive so much the more.

The results obtained from these analytical surveys have proved rather surprising. The most important single region into which the sugar migrates as it leaves the circulating blood is the skin. In the skin we have found figures up to 500 mg. per cent of sugar after glucose injections, whereas the average fasting values for the guclose content of the skin is only 67 mg. per cent. Certain other tissues such as the intestinal walls and the glandular organs also take up sugar much more freely than do the skeletal muscles, but none of these, probably not even the liver, take up sugar from the blood as rapidly as does the skin.

The migration of sugar into the skin is not the result of any selective action or biological activity. It is rather simply the result of unhindered diffusion, and the outstanding difference between muscles and skin is rather that the diffusion process does not extend to the muscles. One might almost say that while the sugar can enter the skin by means of unhindered diffusion, it can enter the muscles only by selective, regulated absorption.

I wish to make it very clear that the distribution phenomena for free sugar are entirely different from the distribution of glycogen which one finds three to five hours after a sugar injection. The glycogen dis-

tribution occurs very much according to expectations. The greatest concentration of stored glycogen is found in the liver, but the largest absolute amount of glycogen is found in the muscles. There are only small traces of glycogen in the skin and these traces are not materially increased by the influx of sugar which occurs after a sugar injection. The glycogen formation is a selective biological process while the preliminary sugar distribution is a result of diffusion.

Whether our discovery of the function of the skin as a temporary reservoir for surplus sugar will prove of practical clinical importance or not, is not for me to say. It is obvious, however, that in diabetes with high blood sugar the skin is also sure to be loaded with sugar. The frequent infections leading to gangrene and amputations might very well be a consequence of the chronic high concentrations of sugar in the skin.

Skin specialists seem very much given to ascribe some skin eruptions to faulty diets. The frequency with which such conditions occur in young people who are extremely intemperate in their eating and particularly in their consumption of cakes and candies does suggest that frequent and excessive influx of sugar into the skin may have something to do with it.

In conclusion I may add that the skin acts as a sort of overflow receptacle not only for sugar, but probably for all diffusible substances which get into the blood. We have proved experimentally that uric acid is taken up in the same way as is glucose; and I suppose that the purple colored skin which is produced by prolonged internal use of silver nitrate may be taken to indicate that in this case also the skin has received more than its share of the circulating chemical.

Dr. Beckett—I want to thank Dr. Folin for the Society for this excellent talk he has given. I will ask Dr. Benedict if he will say something with reference to this subject. Dr. Benedict.

Dr. Benedict—I had not expected to offer any discussion of Dr. Folin's papers.

I might, however, emphasize again the very great interest that attaches to the fundamental side of this question. The way that it was brought home to us some years ago was largely through the point that Allen made in connection with his famous paradoxical law of carbohydrate metabolism. The only limit of sugar tolerance in the animal is the death of that animal, and I think that while Dr. Folin carefully removed the kidneys in each case, that was hardly necessary. The general impression that sugar over and above a certain amount will get into urine is quite erroneous. If one gives 100 grams of glucose, one may get a quarter of a gram in the urine; if one gives 200 grams of glucose, one may get 0.3, 0.4 or 0.5 grams of sugar excreted; and if one gives 400 grams of glucose, four times as much as the first time, he will find in the urine perhaps scarcely one gram of sugar. Thus there is, as Allen pointed out, no limit to the absolute tolerance of that animal until you kill him with sugar. That was one very striking illustration of the fact that there was real interest attached to what becomes of sugar in the animal, and another was brought out by Woodyatt of Chicago some years ago in his famous pump experiment, where for a series of 24 to 36 hours he continuously pumped sugar into a dog; day and night his pump was delivering glucose into the veins at a certain definite rate. When he got through and analyzed for the sugar, he

was unable in any case to account for the quantities above 35 to 50 per cent. Dr. Folin, with his faculty for finding things that other people miss, has found where much of the sugar goes, and we can at least start on the basis now of knowing that there is 100 per cent in the animal, and the study of what becomes of it afterwards will be followed with very much more satisfaction, I think.

Dr. Beckett—Is there anyone else who would like to speak on this subject?

Dr. Muhlberg—I would like to ask Dr. Folin a question. Dr. Folin, in the analysis that you made of the skin, was the sugar found in the true skin or was it in the subcutaneous tissues? The only reason I ask that question is, we know physiologically that the skin is a sort of reservoir and depository for other substances besides sugar. Fat is deposited in the subcutaneous tissues and water is deposited also. We know hydremic, dropsical effusions will occur, particularly in the subcutaneous tissues, and it may be that our skin is a safe deposit box where we pack away things we can't use immediately. I was just wondering if the sugar was found in the subcutaneous tissues rather than in the true skin.

Dr. Folin—In answer to Dr. Muhlberg's question, "Is sugar found in the true skin or in subcutaneous tissue?" We chemists do not know much about anatomy and histology. To us, skin is skin. But I realize that the question raised by Dr. Muhlberg must be answered ultimately by means of further research. I also agree with Dr. Muhlberg that the sugar represents only one illustration, one aspect, of a general process of drifting of materials into the skin region.

The sugar in the skin is not associated with glycogen formation, for the sugar subsequently diffuses from the skin, back into the blood and into the regions where glycogen is formed—the liver and the muscles.

Dr. Beckett—Has anyone else anything to say with reference to this subject? If not, we will pass to the next paper, "A Simple and Rapid Quantitative Test for Sugar in Urine." Dr. W. G. Exton, Dr. A. R. Rose, and Dr. P. V. Wells, of the Prudential Insurance Company.

A SIMPLE AND RAPID QUANTITATIVE TEST FOR SUGAR IN URINE*

by

Wm. G. Exton, M. D., A. R. Rose, Ph. D. and P. V. Wells, D. Sc.

Prudential Insurance Company.

The routine examination of urine for sugar as it has been carried out in the Prudential Laboratory begins with the application of Benedict's qualitative copper test. Ninety-three per cent of the specimens coming into our laboratory exhibit no real copper reduction and are reported sugar negative without further investigation. Those urines (about 7 in the hundred), which give evidence of copper reduction are fermented with controls for one hour at 40° c. Thus, pathological sugar has always been reported quantitatively in the Prudential Laboratory and it may be said that on the whole our procedure has given satisfactory results. This procedure is most economical of time, materials and manipulation, is unaffected by the formalin we use as a preservative, and is more specific than other techniques for glucose, the sugar of paramount interest in life insurance. It suffers from the inability to have always on hand a fresh supply of good yeast and often fails in being as critical as desired in the borderline region between normal and pathological sugar in urine.

In this respect the tests for the sugar of normal

*From the laboratory of the Prudential Insurance Company of America, Newark, N. J.

urine which have been developed by Folin, Benedict, Summer and others are quantitatively superior. They represent a high degree of chemical refinement and have proven extremely valuable in biochemical and physiological research and have contributed greatly to our understanding of carbohydrate metabolism. Unfortunately they are not designed to cover the range of pathological sugar without the troublesome necessity of diluting urines containing more than 0.5% of sugar.

The Junior Scopometer and its use in rapid estimation of amounts of albumin in the urine has been demonstrated to this Association. This instrument has made possible the development of a colorimetric technique which quantitates sugar in urine over both normal and pathological ranges without the necessity of repeating tests on different dilutions of urine or of relying on fermentation or titration methods. This new colorimetry greatly simplifies technique by dispensing with comparison standards. The Junior Scopometer measures the color density of the sample directly with an absorption wedge and scale, and achieves range by employing monochromatic light of different wave lengths. It provides rapid and easy means for employing light filters of appropriate transmissions, thereby extending the range of all colorimetric tests. Those for the normal urinary carbohydrate include the copper tests of Folin and Benedict, the picric acid test of Benedict and the di-nitro salicylic acid test of Summer.

On general principles the copper tests were preferred but are impracticable for rapid routine work on account of their essential nicety of adjustment and more complicated technical demands. As between the

picric and di-nitro salicylic acid methods the latter gives results which while not very different, tend distinctly to run closer to those obtained with the copper techniques and in technical facility is considerably quicker and simpler. Thus di-nitro salicylic acid needs but five instead of fifteen minutes' heating and no dilution step at all as we use it. The great point in its favor, however, is the fact that creatinin does not interfere with di-nitro salicylic acid which permits eliminating altogether any such step as the acetone treatment necessary with picric acid.

We have, therefore, adapted Summer's di-nitro salicylic acid test for Scopometry by modifying his reagent.

Directions for Preparing Reagent**

Pour about 200 cc. of distilled water on 8 grams of sodium hydroxide. When dissolved, add 6 grams of phenol (crystallized). To this when dissolved, add 5 grams of sodium bisulfite (naHSO$_3$ or Na$_2$ S$_2$ O$_5$). Make this up to 500 cc. and add 100 grams Rochelle Salts. When well mixed, add to this 7 grams of di-nitro salicylic acid dissolved in about 300 cc. of distilled water and mix and add water to the 1,000 cc. mark. Keep tightly stoppered and stock preferably in a dark place.

Directions for Making Test

Mix one-fifth cc. of urine with 10 cc. of reagent in a

**Chemicals may be had of the Eastman Kodak Company, and scopometer of the Bausch and Lomb Optical Company, both of Rochester, New York.

test tube. Heat five minutes in boiling water. Cool. Place test tube in Scopometer and read result on the scale.

Figure 1 shows the calibration of one of our experimental wedges for this test and the range of sugar concentrations covered by the method which runs from less than 0.1% to more than 16% of sugar in urine. This latitude is gained by switching from the blue to the green filter provided in the Scopometer, and the mere turn of a lever does this instantaneously. For an occasional test a calibration curve such as the one shown in figure 1 may be used to find the result in terms of percentage of sugar at the intersection of the curve and universal scale reading. For routine work, however, it is handier to use a special scale calibrated for the particular test and then read results directly from the scale as has been found so convenient and satisfactory in making our albumin tests in the Prudential.

In conclusion, it may be noted that with this method neither comparison standards nor repetition of tests on diluted samples is ever necessary and that as regards time and technical simplicity it is, although a quantitative method, on a par with the qualitative copper tests in common use.

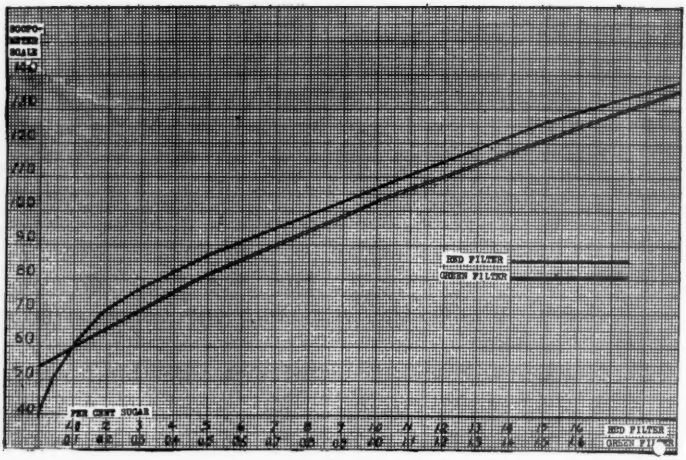

Figure 1

Calibration of an experimental wedge for Prudential sugar test

Dr. Beckett—Has anyone any remarks regarding this paper? Dr. Benedict.

Dr. Benedict—I think when anyone speaks in what may be regarded as a critical way of a method which threatens to supplant his own, he may be accused of ulterior motives, but I can assure you that nowadays if we find that one of our methods has been actually in use for a period of six weeks, we feel that we have done as much as could be expected, so that I shall have no regrets to see the picric acid test pass when it properly should pass.

However, in connection with Dr. Exton's suggestion, I want to make the following points: First, the di-nitro reagent mixed does not keep. There is no question as to that whatever. It was tried out in our own laboratory, tried out in the Metropolitan laboratory, and while it may keep for a period of days, perhaps a week, perhaps two weeks, depending on the amount of oxygen in the bottle and the amount of light and the amount of agitation, it does gradually go to pieces. You have, secondly, the proposition of the fact that the Summer method, the di-nitro salicylic acid reagent, does give definitely different results than those yielded by the picric acid method. The differences are probably very slight, but they will average definitely lower.

From the standpoint of insurance work, I feel that we should not change until a radical change is warranted, only when a method can be shown to be very much superior to the one already in use. Our statistics can never mean anything if we switch from one reagent to another giving results varying by, perhaps, 10 or 15 per cent from what the old method gave. That type of switch is not warranted until the major change

should be adopted on the basis of a very definite advance rather than some slight change, as omitting the acetone step or something of that kind and not very materially improving the procedure.

Dr. Beckett—Are there any other remarks? If not, I will ask Dr. Exton to close the discussion.

Dr. Exton—With reference to what Dr. Benedict says. I can only say that in the original Summer reagent there is a change going on which we also noted in our laboratory, but that with the larger amounts of di-nitro salicylic acid in our modified reagent we haven't noticed any change in the reagent although Dr. Rose has been working with it now for about four months. If any change should appear, we will certainly report it.

I tried to make it clear in speaking that we didn't regard the di-nitro salicylic acid method as any great advance on the picric acid method excepting that it is simpler and quicker. What Dr. Benedict said about the results I also purposely refrained from saying anything about.

The literature has a good deal to say about all of the sugar tests and some writers claim di-nitro salicylic acid to be superior to picric acid because the results more closely approach the results obtained with the more refined copper tests.

We all know that none of these tests give values that we can be perfectly sure of as far as glucose is concerned, and that the results of all the tests are more or less conventional.

In the matter of statistics it may be said that: We still use Dr. Benedict's qualitative copper test in our laboratory and we intend to go on using it. We intend to use this new test only in those cases which show

some copper reduction. We are not interested in the sugar in those urines which do not contain enough to show a positive test with Dr. Benedict's qualitative copper test. We are going to use the new test in place of the yeast fermentation and the phenyl hydrazine tests we have been using. In going over our cards for two years, including both insurance and Longevity Service specimens, we found that only about 7 out of every 100 specimens showed a positive test with Dr. Benedict's copper reagent, and I confess that I have never been able to see the point in quantitating the sugar of normal urines when doing insurance and clinical work.

With the Junior Scopometer we are in a position to choose and simplify any technique that may happen to come along that would, as Dr. Benedict says, be really superior. In the meantime, we can take advantage of the simplest and quickest available sugar technique.

Dr. Beckett—I believe that ends our program, and now it is with very great pleasure that I step to one side and present this gavel to my successor. I want to thank you gentlemen for the many courtesies that I have received from you.

Dr. Daley—Gentlemen, I thank you for the great honor that you have conferred upon me. I shall use my best endeavors to further the aims of this Association during the coming year. In doing so, I will feel free to call upon any of you for the help which I know you will all give.

Is there anything further before the meeting?

Dr. Ward—I am sure that I voice the sentiment of every person here when I state that this has been one of the most instructive gatherings, if not the most instructive gathering, that we have had in the long

history of our Association. I am sure that I also express the sentiment of those present when I state that such a result comes not by chance but because of the painstaking effort of our President, who has given to us such a splendid program.

But apart from the program, Dr. Beckett has rendered a very valuable service, for by the very force of his example, he has increased that spirit of friendship and comradeship among us which is not only so enjoyable but which is of such practical benefit in our contact the one with the other. And so, I would like to submit the following resolution:

Resolved, that the Medical Directors Association in session assembled, express to the officers of the Pacific Mutual Life Insurance Company its sincere appreciation for their generous hospitality and that we also express to our retiring President, Dr. W. W. Beckett, our thanks for the very valuable program that he has prepared and the thoughtful care that he has given to every detail of this convention.

I move, Mr. President, the adoption of this resolution.

The motion was seconded by Dr. Grosvenor and carried amid applause.

Dr. Beckett—Gentlemen, I thank you.

Dr. Daley—The meeting stands adjourned.

The annual dinner of the Association was held at Hotel Biltmore on the evening of Thursday, October 27, 1927.

LIST OF MEMBERS OF THE ASSOCIATION OF LIFE INSURANCE MEDICAL DIRECTORS.

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Angier B. Hobbs, M. D.	New York Life, New York, N. Y.
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Byam Hollings, M. D.	John Hancock, Boston, Mass.

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Henry S. Hutchison, M. D.	Canada Life, Toronto, Ontario.
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Robert W. Mann, M. D.	Imperial, Toronto, Ontario.
William L. Mann, M. D.	Great West, Winnipeg, Manitoba.
William S. Manners, M. D.	Metropolitan, New York, N. Y.
Henry A. Martelle, M. D.	Connecticut Mutual, Hartford, Conn.
Charles F. Martin, M. D.	Standard Life, Montreal, Quebec.
Oscar F. Maxon, M. D.	Franklin Life, Springfield, Ill.
Paul Mazzuri, M. D.	New York Life, New York, N. Y.
Samuel W. Means, M. D.	Metropolitan, New York, N. Y.
John C. Medd, M. D.	Metropolitan, New York, N. Y.
George L. Megargee, M. D.	Metropolitan, New York, N. Y.
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Oscar H. Rogers, M. D.	New York Life, New York, N. Y.
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Joyce T. Sheridan, M. D.	Philadelphia, Philadelphia, Pa.

Arthur L. Sherrill, M. D.	Equitable Life Assurance, New York, N. Y.
Daniel M. Shewbrooks, M. D.	Acacia Mutual, Washington, D. C.
Ross L. Shields, M. D.	Mutual Life, Waterloo, Ont., Canada.
Joseph L. Siner, M. D.	Fidelity Mutual, Philadelphia, Pa.
Donald W. Skeel, M. D.	Occidental Life, Los Angeles, Calif.
Clarence E. Skinner, M. D.	Western Union, Spokane, Wash.
DeWitt Smith, M. D.	Southwestern Life, Dallas, Texas.
James M. Smith, M. D.	American Central, Indianapolis, Ind.
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Thayer A. Smith, M. D.	Mutual Benefit, Newark, N. J.
William B. Smith, M. D.	Connecticut General, Hartford, Conn.
Morton Snow, M. D.	Massachusetts Mutual, Springfield, Mass.
Marion Souchon, M. D.	Pan-American Life, New Orleans, La.
Howard B. Speer, M. D.	Metropolitan, New York, N. Y.
Samuel C. Stanton, M. D.	Farmers National, Chicago, Ill.
Henry F. Starr, M. D.	Pilot Life, Greensboro, N. C.

John B. Steele, M. D.	Volunteer State, Chattanooga, Tenn.
Hector M. Stevenson, M. D.	Aetna, Hartford, Conn.
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